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AND THE RECORDING OF

AMERICAN AND OTHER PATENTED INVENTIONS.

MAY, 1832.

Further remarks on the application of water upon wheels, with reference to a communication under the signature of C. in the last number. *By* JAMES P. ESPY.

TO THE COMMITTEE OF PUBLICATION OF THE FRANKLIN INSTITUTE.

GENTLEMEN,—In the preceding number of this Journal, I find an article signed C., containing, among other things, the following statement. "Mr. Espy arrives at (what I conceive to be) the erroneous conclusion that water let on to a wheel at a less velocity than that of the wheel itself, will give a maximum effect."

I am much obliged to C. for turning my attention to this subject again, particularly as I now believe with C. that my conclusion on this point was an erroneous one.

The question under discussion is, what power is lost at the Fair Mount water works by letting the water on the wheel under a one foot head at an angle of forty-five degrees with the tangent, the wheel moving with a velocity of twelve feet per second?

In the paper which C. criticises I had endeavoured to show that more power was gained by letting the water on the wheel above the point where it would have the velocity of the wheel, than was lost by the retarding effect of inertia, in being suddenly accelerated by the wheel itself.

The calculation was made on the supposition that water, or any other heavy body, produces the same mechanical effect by moving with a uniform velocity downwards the same distance, whatever its velocity may be.

If this supposition is correct, (and perhaps some may still think it is,) my former calculation was right. Perhaps the question can be settled to every body's satisfaction only by experiment. I believe, however, upon mature deliberation, that *time* is the element in this calculation, and not *space.*

For example, the water at Fair Mount comes on the wheel with a velocity six and one half feet slower than the motion of the wheel. Now, if time is the element to be considered, it must lie on the wheel, to balance inertia, as long as a body takes to acquire the velocity of six and a half feet in falling freely through space from the commencement of its motion.

This time is about one-fifth of a second, therefore the water must lie on the wheel one-fifth of a second in order to balance the inertia; but as the wheel moves with a velocity of twelve feet per second, the space will be one-fifth of twelve feet, or nearly twenty-nine inches.

According to this mode of calculation, therefore, the loss of power due to inertia alone is twenty-nine inches, and if to this twelve inches be added, because the water comes on the wheel twelve inches below the surface of the dam, the whole loss of power will be forty-one inches. Whether this mode of calculation will meet the views of C. I do not know, for he does not say definitely what the loss of power is, he only says, it is "more than twenty-seven inches."

From these remarks, C. will perceive that, as he imagined, I have "at once seen the error into which I had inadvertently fallen, and as promptly corrected it."

I cannot, however, agree with C. "that L. M. has erred in supposing that water in motion at a velocity due to one foot head, viz. eight feet per second, at an angle of forty-five degrees to the direction of the wheel, would oppose a resistance to the buckets by the influence of its inertia, proportioned to the difference between the velocity of the wheel and that of the water in the direction of the wheel, viz. six and a half feet." Nor do I think that the "error is obvious from the fact, that the water strikes the soaling of the wheel at an angle of forty-five degrees, by which its motion, instead of being destroyed, is only changed to the direction of the wheel's motion, and that therefore, all which can be lost by this change of direction, is what may be occasioned by the agitation of the water, and, therefore, it moves in the direction of the wheel at a velocity but little less than eight feet per second." For, in the first place, we have no reason for supposing that the water moves faster in the direction of the wheel after it strikes the soaling than before; and, in the second place, we are sure, "from first principles," if it does move faster it is only by reacting on the wheel.

For action and reaction are equal, and in opposite directions. Therefore, if the water spends its force on the soaling of the wheel in changing its direction, if that soaling is parallel to the tangent, its velocity in the direction of the tangent can neither be increased nor diminished.

If we suppose the water and the soaling both perfectly elastic; the water upon striking the soaling would rebound, making the angle of reflection equal to the angle of incidence; and the velocity in the

direction of the tangent, would evidently remain the same. If we suppose the water and the soaling both perfectly hard and smooth, upon striking the soaling, the motion of the water in the direction of the radius of the wheel would be entirely destroyed, whilst that in the direction of the tangent would remain the same.

I think it is not necessary to pursue this subject further, especially as I am sure C. will have the candour to acknowledge his mistake provided he should be led to discover it by these remarks.

As to the other point in controversy, perhaps some may think that I have given it up too readily, and may still be inclined to believe that my first method of calculating was founded on true principles, and that it is a universal rule, without an exception, that the mechanical effect of water is to be measured by the distance it descends, and in no instance by the time. I will only observe that the point can be settled to the satisfaction of all by the following simple experiment.

Let the water be admitted to a water wheel at various points from the bottom to as near the surface of the water as possible; if *time* is the true element in the calculation in question, the wheel will move with the greatest velocity when the water is introduced at the bottom of the wheel; and it will move slower and slower as it is introduced higher up; but if the space descended is the true element, the velocity of the wheel will be greatest when the water is introduced under one fourth of the whole head, that is, one fourth being above and three fourths below the point of introduction. As the place of introduction varies from this point, the wheel will move slower, until finally the motion will be slowest of all when it is introduced at the bottom of the wheel, or at the surface of the water, at which points the velocities will be equal.

Perhaps I may be permitted, without being considered as departing altogether from the subject of this communication, to introduce again to the notice of C. an experiment which I mentioned in a former controversy with him,* as proving positively that momentum is proportional to the velocity of a body, and not proportional to the square of the velocity, as he contended.

The experiment is this—Let two non-elastic bodies, of different masses, meet each other in opposite directions, with velocities inversely proportional to their masses, the momentum of each will be destroyed, for after the stroke there will be no motion.

To this I will add another: Let two holes of equal areas be made in a vessel containing water, one four feet and the other sixteen feet below the surface of the water in the vessel; it is known that the velocity of the water issuing from the lower hole will be double that of the other, and the quantity of water double in a given time. It is also known, by experiment, that the pressures which these two streams make by impulse against solid planes brought up near the openings, are as four to one. Now the quantity of matter being double, if the momentum is as the square of the velocity, the pressure should be as eight to one.

* See Journal of Franklin Institute, vol. iv. p. 213.

By referring to the article mentioned above, the reader will find that there is a distinction to be made between momentum, or force, and mechanical power, and that it is only the latter which follows the law of the squares of the velocities.

Very respectfully, yours,

J. P. Espy.

Notes of an Observer.—*On the aberration of Light as a means of testing the Cartesian and Newtonian theories of Light.*

In this country, and also in England, the Newtonian theory of light has been almost universally received, both as to colours and to the nature of light, as consisting of material particles projected from luminous bodies. It has, however, been lately shown by Dr. Brewster that the prismatic spectrum is capable of being further analyzed, and that there are but three colours, red, yellow, and blue, and that the intermediate colours are formed by the overlapping of the two contiguous ones.

This analysis was made not by the prism alone, but by letting each of the prismatic colours fall on coloured glass, and he found that when orange, for example, fell on a coloured glass which would absorb red and transmit yellow, the orange was analyzed, for nothing but yellow was transmitted; and when a different coloured glass was used, the red was transmitted, and the yellow absorbed; thus showing that the prismatic orange consists of two kinds of rays of the same refrangibility, but of different colours; and so of green and violet.

It appears also, from the following experiment, that the rays of the same colour, are of different refrangibility.

Let the solar light, after it is separated by the prism, fall upon a thin piece of smalt-blue glass, of proper thickness, and "the red light will be separated into two well defined portions, parted from one another by a broad and perfectly black band, and wholly undistinguishable in colour. Of these, the lowest, or least refrangible, corresponds to the extreme red of the spectrum, and is a perfectly homogeneous light; the other is nearly homogeneous, and without the slightest shade of orange. The orange is altogether obliterated, the next colour being a well defined band of pure and full yellow, which is separated from the second red by a small well defined black line, and from the green by a dark interval." See Lloyd on Light and Vision.

These experiments leave no room to doubt that there are only three primary colours; but as to the nature of light, whether it is caused by radiation or undulation, though the latter theory is evidently gaining ground, it is not yet decided, no decisive experiment having been discovered to settle the matter.

It is acknowledged that, if the Newtonian theory is correct, light moves with greater velocity upon entering a denser medium, from a rarer; but according to the undulatory theory it moves slower upon entering a denser medium.

This being the fact, I propose the following as an experimentum crucis to decide the question.

Let two telescopes be directed to some star near the pole, which passes the meridian above the pole near midnight, and be firmly fixed in such position that a transit will take place at the same instant over a particular division of the micrometers in each of the telescopes. Let the instruments remain in this position for several successive nights, so as to be sure the transit takes place in both at the same instant; then let one of the telescopes be filled with some transparent fluid, as water, having previously made the arrangement to effect this, and also to accommodate the focal distance without changing the position of the instrument. Let a transit of the same star be now observed; if the light moves faster in the water than in the air, the transit will take place sooner in the water telescope than in the air one; but if the light moves slower in the water than in the air, the effect will be the reverse.

If, for example, the light moves only with half the velocity in water that it does in air, the difference in space of the transits in the two instruments will be twenty seconds of a great circle, and if a star be chosen near the north pole, it may amount to many seconds of time.

My view may be explained by the following figure.

Let *a d* be a ray of light passing from a star, *a*, and falling on the object glass of a telescope at *e*. It is known from the aberration of light that if the telescope, from the motion of the earth in her orbit, moves from *c* to *d*, while a ray of light moves from *e* to *d*, that the star *a* will appear in the direction *c b*, and be twenty seconds of space from its true position. If now, as the Newtonian theory requires, a ray of light, upon entering a telescope filled with water, or sulphuret of carbon, should move faster than it does in air, then the telescope could not move from *c* to *d*, while the ray of light is moving from *e* to *d*, and, of course, the star would not appear to be twenty seconds from its true place, and would be seen in some place between *a* and *b*—nearer to *a* as its velocity is greater, and finally at *a*, if the velocity is infinite. If, on the contrary, as the Cartesian hypothesis requires, the ray of light begins to move slower upon entering the fluid telescope, then will the telescope be carried by the motion of the earth farther than from *c* to *d*, while the ray of light is moving from *e* to *d*, and of course the star will appear more than twenty seconds from its true place.

If those who have the means of making this experiment should

avail themselves of it, and communicate the result to the public; it would gratify at least the writer of this article.

Ever Pointed Pencils.

We should be at a loss to name an article which in so short a space of time had so completely won the favour of the public, and put out of use one which was possessed by almost every person, and worn in almost every pocket, as has the ever pointed pencil. What may next be done in this age of rapid improvement, we may probably learn to-morrow; we think, however, that it will not appertain to an instrument of this kind, excepting it may be in its embellishments, as in point of utility it seems well to deserve the motto of *ne plus ultra*.

It ought to be universally known that the inventor of this ingenious instrument, was not himself the patentee. We are indebted for it to Mr. John J. Hawkins, civil engineer, a citizen of the United States, although a native of England, and now a resident there. Mr. Hawkins lived for several years in Philadelphia, but returned to England some five and twenty years ago, with the intention, however, of soon returning to the United States, an intention which he has always cherished, and in writing to his friends here, he has uniformly expressed the hope of soon returning *home*.

Mr. Hawkins might readily supply a new version of "A Century of inventions" made by himself; many of them manifesting talents of a very high order, but in most instances not calculated to increase his fortune in this age of utility; and in those which might have done so, as in the case of the ever pointed pencil, which he sold to Mr. Mordan for a small sum, the fruits of his genius have been reaped by others.

At one period Mr. Hawkins was the proprietor of a very interesting museum in London, consisting almost entirely of his own mechanical contrivances. It served as a striking proof of the fertility and versatility of his genius, but as its merits could not be appreciated by "the million," it brought him no other reward. We have now, among our papers, a catalogue of this exhibition, and may hereafter particularly notice some of its contents. The Physiognotrace, by which so many thousand profiles have been taken, first at Peale's museum in Philadelphia, and subsequently in numerous other places, was invented by him, as also was another ingenious instrument, the Manifold Letter Writer, operating likewise upon the principle of the pentagraph, by which two or three pens were made to act by the direction of one.

We have been led to the recording of the preceding remarks and memoranda, from having recently obtained a very beautifully finished ever pointed pencil from the manufactory of Mr. Wm. H. Hale, of Brooklyn, New York. Although the manufacture has become one of great extent in this country, it is but recently that the productions of our workshops have been able to vie with those of England in point of high finish and embellishment, but such is now the case, and the one to which we have just alluded, is the most elegant

Plate V.

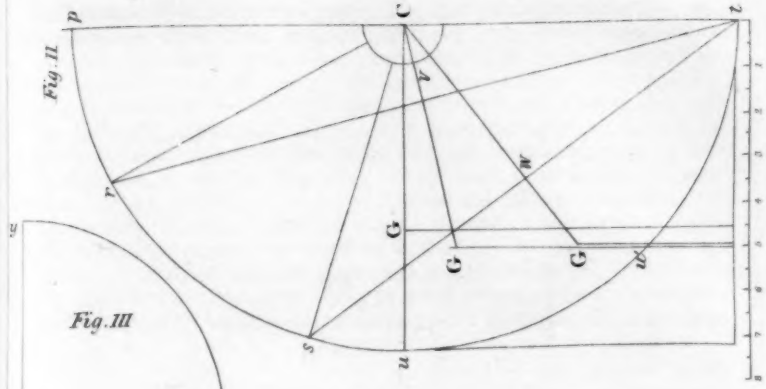
Fig. II
p
C
t
A
w
G
G
G
N
r
s
u

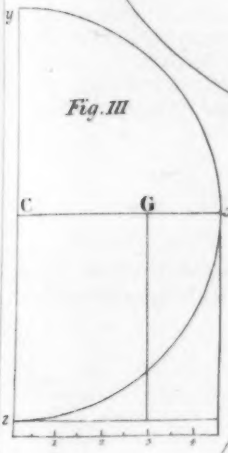
Fig. III
y
C
G
x
z

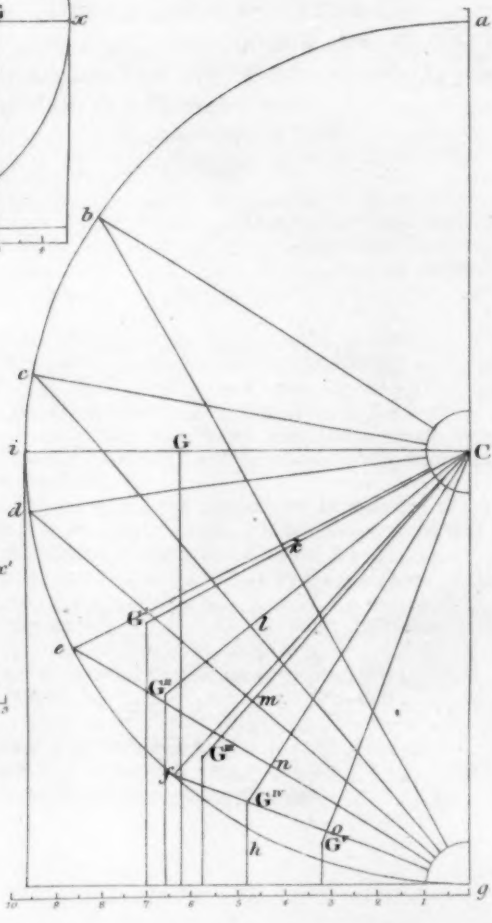
Fig. I
a
b
c
i
G
C
d
e
f
g
G'
G''
G'''
G''''
G'''''
k
l
m
n
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h

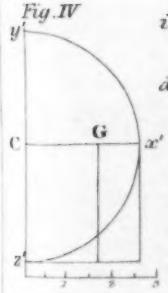
Fig. IV
y'
C
G
x'
z'

and tasteful that we have seen. We had recently noticed in the shops some which were ornamented in the same style, but whether or not by the same hand, we cannot tell; if they were, they exhibit the imperfection usually attendant on earlier efforts, whilst that before us manifests the effect of accurately made machinery, directed by the hands of skill and taste. The ornamenting of the stem is of the kind very properly denominated *damask;* the pattern is produced by a ground formed by the ruling of fine lines upon a polished surface, leaving a brilliant wreath of flowers and foliage, which has the appearance of being raised above the ground. The point through which the lead passes, we observe, is of steel; an improvement that renders permanent the part which was most liable to fail. If we have any objection to this pencil it is its great beauty, which we are unwilling to mar by forcing it into the company of penknives and cents.

EDITOR.

FRANKLIN INSTITUTE.

Continuation of the Report of the Committee of the Franklin Institute of Pennsylvania, appointed May, 1829, *to ascertain, by experiment, the value of Water as a Moving Power.*

(Continued from p. 157.)

WHEEL NO. II.

THE foregoing tables contain the results of the different experiments made with wheel No. I. These being finished, that wheel was removed and No. II. (fifteen feet in diameter,) substituted for it, upon the same axis. The breast was altered to adapt it to the curvature of the wheel, and the requisite change made in the tail race.

The proportion of friction in wheel No. II. to the weight, was ascertained by the method already described as having been applied in the case of No. I. This gave one per cent. for the ratio in the wheel as well as in the drum above. The reduction in the ratio of friction having taken place in both the wheel and drum, seems to point to the increased smoothness of the gudgeons, and their supports, as the cause of the diminution.

We proceed to calculate the amount of friction for the different weights applied in the experiments. The plan pursued will be that adopted in determining the friction of wheel No. I.

First. Constant *inactive* weight borne by the gudgeons of the wheel and drum during the experiments.

Weight of the wheel, - -	1900 lbs.	
Weight of that part of the chain which was between the barrel of the shaft and the drum,	264 ,,	
Weight of the drum, - -	200 ,,	
Total constant *inactive* weight, -	2364 lbs.	
Friction upon this at one per cent, -		23.64 lbs.

Second. Constant weight *resisting* the mo-

tion of the wheel, and which was borne by the gudgeons of the wheel and drum.		
That part of the chain which was between the barrel of the shaft of the wheel and the ground, - - -	20 lbs.	
The iron basket used to contain the weight,	126 ,,	
Three bars of lead weighing together	111 ,,	
Total constant *resisting* weight, -	257 lbs.	
Friction due to this weight at one per cent.		2.57 lbs.
Total friction from *constant weight*,		26.21 lbs.
The centre of gravity of the water in the buckets of the wheel, when supplied by chute No. 3, (Fig. II. Plate V.) was 5.00 feet from the axis of the wheel, and the barrel about which the chain was wound was one foot from the same axis; hence, to raise 257 lbs. the constant resisting weight, and overcome a friction of 26.21 lbs. the constant friction just found, required a weight of water of	56.64 lbs.	
Friction due to this at one per cent.		.57 lb.
Whole amount of friction when 257 lbs. was raised, - - -		26.78 lbs.
To find the additional friction due to each of the bars of lead which were used as weights, we have,		
Weight of the lead, - -	103.00 lbs.	
To balance this weight and the friction due to it, (103 lbs.+1.03 lb.) or 104.03 lbs., required, at 5 feet from the axis, a weight of water of - - -	29.81 ,,	
Total, - -	133.81 lbs.	
Friction for each bar of lead, -		1.24 lb.

An examination of the amount of friction at the several chutes in wheel No. I. showed such slight variations for the friction due to each lead, that it was not considered necessary to apply calculation to each of the chutes by which water was admitted to wheel No. II., the friction was taken as just determined for all the experiments with this wheel. The distances of the centre of gravity of the loaded part of the wheel when water was admitted through the different chutes, were for chute No. 1, 4.61 feet, for No. 2, 5.1, No. 3, 5.0, No. 4, 4.2.

When eight leads were added to the constant weight in the basket the end *o* (Plate III. vol. vii.) of the shaft was suspended. By a calculation exactly similar to that given in page 79, vol. viii. the friction for each lead, after the eighth, was found to be 2.95 lbs.

We proceed to the details in relation to wheel No. II.

This wheel was fifteen feet in diameter, twenty inches in breadth, and sixteen inches in the clear between the cants, which were six inches deep.

The buckets used were of the elbow form, the depth fourteen inches, the width of elbow three inches, and opening at the throat two and three-fourths inches. The number of buckets was fifty.

It was not considered necessary to furnish these buckets with air vents, the results of experiments upon wheel No. I. having been, in the upper gates, decidedly unfavourable to their use.

The water was applied to this wheel at four different points. No. 1, was an overshot aperture. The height of the point at which the water from No. 2 was delivered, was 14.25 feet above the bottom of the wheel. The corresponding height for chute No. 3 was 10.46. For No. 4, 6.96 feet. The chutes were of the form and dimensions of those applied to wheel No. I. The forms of the gates were those used in the corresponding apertures in wheel No. I, chute No. 1, having a gate of the form *c*, Fig. 3, Plate IV. vol. viii.

The order of the experiments was similar to that described in the case of wheel No. I. The water was admitted through one chute, and with a given aperture and head, and the weight raised was varied until the maximum effect had been passed. The opening was next changed, and a similar series of experiments made. Finally the head was changed.

The experiments made upon one point of admission of the water to the wheel, will form the subject of one table. The tables will be distinguished by the small Roman letters, and, when divided, the parts will be designated by the common (Arabic) numerals. The columns, unless in particular cases to be noted, will correspond to those used in the foregoing tables.

It will be observed that the height through which the weight was raised in these experiments, was made exactly forty feet.

The general series of experiments made with this wheel will be followed by a set having for their object to determine the relative openings required, and quantities of water expended in performing a given amount of work in a given time, when the water was applied at different points of the wheel, and with different heads above the gates.

The details in relation to the series just referred to will precede the table of results.

TABLE a.—PART I.

WHEEL No. II.—CHUTE No. 1.—*Elbow buckets. Close breast. Water let on at upper centre of wheel.*

No. of Exper't.	Head of water above. Bttm. of gate.	Top of bkt.	Bttm. of bkt.	Width of Aperture.	Weight raised.	Friction.	Sum of friction and weight raised.	Height raised.	Time.	Velocity per second.	Wt of water expended.	Head and fall.	Power.	Effect.	Ratio, power being 1.	Maximum effect.	Velocity at maximum.	Observations.
	Feet.	Feet.	Feet.	In.	Pds.	Pounds	Pounds.	Feet.	Scds.	Feet.	Pds.	Feet.						
1	5.50	5.75	6.35	1.00	463	29.26	492.26	40.0	19	14.90	1640	20.5	336200	196904	.585			
2					669	31.74	700.74		23	12.30	1935		396675	280296	.706			
3					772	32.98	804.98		25	11.32	2150		440750	321992	.730			
4					875	34.22	909.22		28	10.12	2400		492000	363688	.739			
5					978	35.46	1013.46		32	8.85	2680		549400	405384	.738			
6					1081	36.70	1117.70		34	8.33	2925		599625	447080	.745			
7					1184	39.66	1223.66		38	7.45	3200		656000	489464	.746	.746	7.45	
8					1287	42.61	1329.61		41	6.90	3515		720575	531844	.738			
9					1390	45.56	1435.56		46	6.15	3800		779000	574224	.737			
10					1493	48.51	1541.51		49	5.78	4125		845625	616604	.729			
11					1596	51.46	1647.46		53	5.34	4475		917375	658984	.718			
12	3.00	3.25	3.85	1.00	978	35.46	1013.46	40.0	46	6.15	2815	18.0	506700	405384	.800			
13					1081	36.70	1117.70		51	5.55	3100		558000	447080	.801	.801	5.55	
14					1184	39.66	1223.66		57	4.98	3460		622800	489464	.786			
15					1287	42.61	1329.61		62	4.57	3865		695700	531844	.764			
16	3.00	3.25	3.85	1.50	1287	42.61	1329.61	40.0	41	6.90	3665	18.0	659700	531844	.806			
17					1390	45.56	1435.56		44	6.44	3900		702000	574224	.818	.818	6.44	
18					1493	48.51	1541.51		48	5.90	4240		763200	616604	.808			
19					1596	51.46	1647.46		52	5.44	4590		826200	658984	.797			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	

TABLE a.—PART II.

WHEEL No. II—CHUTE No. 1.—*Elbow Buckets. Close Breast. Water let on at upper centre of wheel.*

No. of Exper't.	Head of water above. Btm. of gate.	Head of water above. Top of bkt.	Head of water above. Btm. of bkt.	Width of Aperture.	Weight raised.	Friction.	Sum of friction and weight raised.	Height raised.	Time.	Velocity per second.	Wt of water expended.	Head and fall.	Power.	Effect.	Ratio, power being 1.	Maximum effect.	Velocity at maximum.	Observations.
	Feet.	Feet.	Feet.	In.	Pds.	Pounds	Pounds.	Feet.	Scds.	Feet.	Pds.	Feet.						
20	1.50	2.35	1.75	1.50	875	34.22	909.22	40.0	46	6.15	2630	16.50	433950	363688	.838			
21					978	35.46	1013.46		52	5.44	2925		482625	405384	.840	.840	5.44	
22					1081	36.70	1117.70		58	4.90	3250		536250	447080	.834			
23	1.50	2.35	1.75	1.75	1081	36.70	1117.70	40.0	50	5.66	3220	16.50	531300	447080	.841	.841	5.66	
24					1184	39.66	1223.66		57	4.98	3540		584100	489464	.838			
25					1287	42.61	1329.61		61	4.65	3950		651750	531884	.816			
26	1.00	1.85	1.25	1.75	669	31.74	700.74	40.0	46	6.15	2125	16.00	340000	280296	.824			
27					772	32.98	804.98		53	5.34	2425		388000	321992	.829			
28					875	34.22	909.22		59	4.81	2700		432000	363688	.842			
29					978	35.46	1013.46		65	4.35	2960		473600	405384	.855	.855	4.35	
30	0.84	1.69	1.09	1.75	463	29.26	492.26	40.0	43	6.60	1553	15.84	245995	196904	.800			
31					566	30.50	596.50		53	5.34	1826		291238	238600	.819			
32					669	31.74	700.74		60	4.72	2130		337392	280296	.830	.830	4.72	
33					772	32.98	804.98		68	4.17	2450		388080	321992	.829			
34	0.75	1.60	1.00	1.75	463	29.26	492.26	40.0	61	4.65	1497	15.75	235777	196904	.834			
35					566	30.50	596.50		68	4.17	1816		286020	238600	.834			
36					669	31.74	700.74		83	3.41	2116		333270	280296	.841	.841	3.41	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	

TABLE b.—PART I.

WHEEL No. II.—CHUTE No. 2.—*Elbow buckets. Close breast. Bottom of gate* 14.25 *feet above bottom of wheel.*

No. of Exper't.	Head of water above. Btm. of gate.	Head of water above. Top of bkt.	Head of water above. Btm. of bkt.	Width of Aperture.	Weight raised.	Friction.	Sum of friction and weight raised.	Height raised.	Time.	Velocity per second.	W'tofwater expended.	Head and fall.	Power.	Effect.	Ratio, power being 1.	Maximum effect.	Velocity at maximum.	Observations.
	Feet.	Feet.	Feet.	In.	Pds.	Pds.	Pounds.	Feet.	Scds.	Feet.	Pds.	Feet.						
1	2.25	2.75	3.93	1.25	1287	42.61	1329.61	40.0	67	4.22	4335	16.50	715275	531844	.743			
2					1390	45.56	1435.56		73	3.88	4680		772200	574224	.743			
3	1.50	2.00	3.18	1.25	463	29.26	492.26	40.0	36	7.87	1610	15.75	253575	196904	.776			
4					566	30.50	596.50		40	7.08	1920		302400	238600	.789	.789	7.08	
5					669	31.74	700.74		45	6.29	2275		358312	280296	.782			
6					772	32.98	804.98		54	5.24	2620		412650	321992	.779			
7					875	34.22	909.22		60	4.72	2970		467775	363688	.777			
8					978	35.46	1013.46		68	4.17	3330		524475	405384	.773			
9					1081	36.70	1117.70		74	3.82	3700		582750	447080	.767			
10	1.00	1.50	2.68	1.50	463	29.26	492.26	40.0	35	8.12	1675	15.25	255437	196904	.767			
11					566	30.50	596.50		42	6.74	2000		305000	238600	.782			
12					669	31.74	700.74		49	5.78	2340		356850	280296	.785	.785	5.78	
13					772	32.98	804.98		55	5.15	2700		411750	321992	.782			
14					875	34.22	909.22		68	4.17	3080		469700	363688	.774			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	

TABLE b.—PART II.

WHEEL NO. II.—CHUTE NO. 2.—*Elbow buckets. Close breast. Bottom of gate* 14.25 *ft. above bottom of wheel.*

No. of Exper't.	Head of water above. Btm. of gate.	Top of bkt.	Btm. of bkt.	Width of Aperture.	Weight raised.	Friction.	Sum of friction and weight raised.	Height raised.	Time.	Velocity per second.	Wt of water expended.	Head and fall.	Power.	Effect.	Ratio, power being 1.	Maximum effect.	Velocity at maximum.	Observations.
	Feet.	Feet.	Feet.	In.	Pds.	Pounds	Pounds.	Feet.	Scds.	Feet.	Pds.	Feet.						
15	1.00	1.50	2.68	1.75	566	30.50	596.50	40.0	37	7.65	2015	15.25	307287	238600	.776			
16					669	31.74	700.74		43	6.60	2340		356850	280296	.785			
17					772	32.98	804.98		48	5.90	2660		405650	321992	.793	.793	5.90	
18					875	34.22	909.22		54	5.24	3015		459787	363608	.791			
19					978	35.46	1013.46		66	4.27	3390		516975	405384	.784			
20					1081	36.70	1117.70		73	3.88	3790		577975	447080	.773			
21	0.75	1.25	2.43	1.75	463	29.26	492.26	40.0	46	6.15	1700	15.00	255000	196904	.772			
22					566	30.50	596.50		52	5.44	2025		303750	238600	.785			
23					669	31.74	700.74		55	5.15	2370		355500	280296	.788	.788	5.15	
24					772	32.98	804.98		65	4.35	2740		411000	321992	.783			
25					875	34.22	909.22		73	3.88	3100		465000	363688	.782			
26					978	35.46	1013.46		79	3.58	3445		516750	405384	.784			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	

TABLE C.

WHEEL No. II.—CHUTE No. 3.—*Elbow buckets. Close breast. Bottom of gate* 10.46 *feet above bottom of wheel.*

No. of Exper't.	Head of water above. Btm. of gate.	Top of bkt.	Btm. of bkt.	Width of Aperture.	Weight raised.	Friction.	Sum of friction and weight raised.	Height raised.	Time.	Velocity per second.	Wt of water expended.	Head and fall.	Power.	Effect.	Ratio, power being 1.	Maximum effect.	Velocity at maximum.	Observations.
	Feet.	Feet.	Feet.	In.	Pds.	Pds.	Pounds.	Feet.	Scds.	Feet.	Pds.	Feet.						
1	3.04	4.04	5.22	1.25	978	35.46	1013.46	40.0	46	6.15	4900	13.50	661500	405384	.612	.612	6.15	
2					1081	36.70	1117.70		56	5.06	5650		762750	447080	.586			
3					1184	39.66	1223.66		65	4.35	6410		865350	489464	.565			
4	2.04	3.04	4.22	1.25	772	32.98	804.98	40.0	46	6.15	4100	12.50	512500	321992	.628			
5					875	34.22	909.22		50	5.66	4550		568750	363688	.639	.639	5.66	
6					978	35.46	1013.46		61	4.65	5210		651250	405384	.622			
7	1.04	2.04	3.22	1.75	669	31.74	700.74	40.0	36	7.87	4025	11.50	462875	280296	.605			
8					772	32.98	804.98		44	6.44	4200		483000	321992	.666	.666	6.44	
9					875	34.22	909.22		50	5.66	4790		550850	363688	.660			
10					978	35.46	1013.46		55	5.15	5410		622150	405384	.651			
11					1081	36.70	1117.70		63	4.50	6025		692875	447080	.645			
12	0.79	1.79	2.97	1.75	772	32.98	804.98	40.0	52	5.44	4275	11.25	480937	321992	.670			
13					875	34.22	909.22		57	4.98	4775		537187	363688	.677			
14	0.79	1.79	2.97	2.00	669	31.74	700.74	40.0	44	6.44	3680	11.25	414000	280296	.677	.677	6·44	
15					772	32.98	804.98		48	5.90	4275		480937	321992	.670			
16					875	34.22	909.22		55	5.15	4870		547875	363688	.663			
17					978	35.46	1013.46		63	4.50	5510		619875	405384	.653			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	

TABLE d.

WHEEL No. II.—CHUTE No. 4.—*Elbow buckets. Close breast. Bottom of gate* 6.96 *feet above bottom of wheel.*

No. of Exper't.	Head of Water above.			Width of Aperture.	Weight raised.	Friction.	Sum of friction and weight raised.	Height raised.	Time.	Velocity per second.	Wt of water expended.	Head and fall.	Power.	Effect.	Ratio, power being 1.	Maximum effect.	Velocity at maximum.	Observations.
	Btm. of gate.	Top of bkt.	Btm. of bkt.															
	Feet.	Feet.	Feet.	In.	Pds.	Pounds	Pounds.	Feet.	Scds.	Feet.	Pds.	Feet.						
1	3.04	4.21	5.39	1.00	566	30.50	596.50	40.0	41	6.90	4200	10.00	420000	238600	.568	.568	6.90	
2					669	31.74	700.74		49	5.78	5150		515000	280296	.544			
3					772	32.98	804.98		61	4.65	6260		626000	321992	.514			
4	3.04	4.21	5.39	1.25	566	30.50	596.50	40.0	36	7.87	4320	10.00	432000	238600	.552			
5					669	31.74	700.74		41	6.90	4900		490000	280296	.572	.572	6.90	
6					772	32.98	804.98		51	5.55	6100		610000	321992	.527			
7	2.04	3.21	4.39	1.75	566	30.50	596.50	40.0	37	7.65	4400	9.00	396000	238600	.602	.602	7.65	
8					669	31.74	700.74		45	6.29	5310		477900	280296	.586			
9					772	32.98	804.98		56	5.06	6500		585000	321992	.550			
10	1.04	2.21	3.39	1.75	360	28.02	388.02	40.0	38	7.45	3080	8.00	246400	155208	.630			
11					463	29.26	492.26		48	5.90	3900		312000	196904	.631	.631	5.90	
12					566	30.50	596.50		58	4.90	4875		390000	238600	.611			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	

Quarterly Meeting.

The thirty-third quarterly meeting of the Institute was held at the Hall of the Institute April 19, 1832.

Thomas Fletcher, Vice President, in the chair.

The minutes of the last meeting were read and approved.

The quarterly report of the Board of Managers was read and accepted, when, on motion, it was referred to the standing committee for publication.

The quarterly report of the Treasurer was read and accepted.

The Corresponding Secretary read a communication from the American Institute of the city of New York, accompanied by one hundred copies of the address delivered before that Institute by the Hon. Edward Everett at their last Annual Fair; the address was then distributed among the members of the Institute present.

The committee appointed to inquire into the statistical wealth of the state, reported that the labours of the sub-committee for Dock ward were finished, the tables of which were presented, showing that the value of the domestic manufactures of that district amounted to upwards of seven hundred thousand dollars.

On motion, the thanks of the Institute were presented to the sub-committee for Dock ward for the promptness with which they had attended to the duties assigned them.

On motion, it was

Resolved, That the committee on statistics be authorized to adopt such measures as they may deem adviseable for the purpose of procuring a sufficient amount of funds to defray the expenses that will be incurred in the prosecution of the duties assigned to them.

The following donations were presented to the Institute.

By Messrs. Carey & Lea.

Lardner's Cabinet Cyclopædia, No. 13, *on Silk, and No.* 14, *on Natural Philosophy.*

A Geological Manuel, by H. T. De La Beche.

Renwick on the Steam Engine.

By Profr. Alexander Dallas Bache.

Report of Committee of American Philosophical Society on Astronomical Observations, February 12, 1831.

By Isaac Hays, M. D.

Euclid's Geometry, by Bonnycastle.

Experiments on Anthracite, Plumbago, &c. by Lardner Vanuxem.

By Reuben S. Gilbert.

The Cabinet of Natural History and American Rural Sports, vol. 1.

The Corresponding Secretary laid on the table the following works received in exchange for the Journal of the Institute, viz.

London Journal of Arts and Sciences, for October, November, and December, 1831, and January and February 1832.

Repertory of Patent Inventions, October, November, December, and Supplement, 1831, and January and February, 1832.

Mechanics' Magazine, for September, October, and December, 1831, and January, 1832.

Register of Arts and Journal of Patent Inventions, for October, November, and December, 1831, and January and February, 1832.

Recueil Industriel, for July and August.

Bibliothéque Physico-économique, for September, October, November and December.

Annales de Chimie et de Physique, for June, July and August.

Bulletin de la Societé d'Encouragement pour l'Industrie Nationale, for July, August, and September.

Annales des Mines, 5th and 6th book, 1830.

North American Review, January and April.

American Annals of Education, January, 1832.

Journal of the Philadelphia College of Pharmacy, for January and April.

The American Quarterly Review, for March.

Ladies' Book, for January, February, March and April.

The American Journal of Arts and Sciences, for January.

The Southern Review, for February.

Museum of Foreign Literature and Arts, for January, February, and March.

The Illinois Monthly Magazine, for January and February.

THOMAS FLETCHER, *V. President.*

J. HENRY BULKLEY, *Rec. Sec.*

Thirty-third Quarterly Report of the Board of Managers of the Franklin Institute.

To the Franklin Institute of the state of Pennsylvania for the promotion of the Mechanic Arts, the Board of Managers offer their thirty-third quarterly report.

The closing winter has been, as usual, a season of active usefulness. The lectures delivered regularly by our several professors, have continued to attract attention, and to convey instruction. It is a matter of regret that but few of our members avail themselves of the opportunity of delivering volunteer lectures; a branch of our duties from which much benefit had been expected at the outset of the Institute. Our schools have also continued as announced in our last report, and the Board entertain the opinion of their usefulness and importance that was then expressed.

The investigations commenced by the Institute are continued with all due attention. The experiments on steam boilers have been carried very far, and that part which embraces the properties of steam and the various phenomena which it exhibits under different circumstances, may be said to be nearly completed. Preparations have been made to investigate the strength of the various kinds of iron and of copper used in the construction of steam boilers. To effect this successfully a machine has been constructed under the directions of the

sub committee to which this branch has been intrusted. The expenditure on account of this machine, though considerable, is believed to have been judicious, as it enables us to test the strength of all the different kinds of iron or copper, and at different temperatures; indeed to test the strength of any material which may be used in the arts. This expense will be defrayed from the fund which has been so liberally placed at the disposal of the Institute. In order to derive as much benefit as possible from this machine, the Institute invite their members and the public at large, to send any specimens of iron, &c. the strength of which it is desired to ascertain; they may be directed to William Hamilton, Actuary of the Institute; and the Board pledge themselves that every variety sent will be fairly and strictly tested, under the superintendence of the appropriate committee.

The investigation into the statistical wealth of Pennsylvania has led to some expenses which the Board have been called upon to defray; one hundred dollars have already been appropriated to this purpose, and it appears that there is still a balance of about fifty dollars due to meet past disbursements. In adverting to this fact, and to the circumstance that if the investigation is likely to be useful, it must be at a considerable additional expense for postage, printing, clerk hire, &c., the Board would respectfully submit to the Institute that the funds of the society are so limited in extent, and so imperiously required for other necessary expenditures, that it seems to them desirable to defray the expenses of the statistical investigation from a separate fund, which it is believed could be raised by subscription among those most interested in its result. Probably a sum of $500 or $600 would be sufficient for the purpose, and it is not unlikely that it could be raised by some exertion on the part of the members.

The Board have taken some preliminary steps towards the better arrangement and disposition of their cabinet of models, &c.

All which is respectfully submitted by

WILLIAM H. KEATING, *Chairman.*

WILLIAM HAMILTON, *Actuary.*

Notice of some assertions made by Mr. Joshua Shaw in the Journal of the Institute for September last, on the subject of Percussion Locks for Cannon, by the writer of the article under the signature of Justice.

TO THE EDITOR OF THE JOURNAL OF THE FRANKLIN INSTITUTE.

SIR,—The writer of the article signed "Justice," which appeared in your Journal for May last, has recently met with a rejoinder which occupies six pages of the number of the Journal for September last.

It is not designed to travel over the whole of this huge and laboured production, nor to detect and expose the numberless errors of fact and inference with which it abounds. But with your per-

mission, and with due respect for the maxim quoted in your appended note, a few remarks will be offered in reply.

The first publication on this subject, did, in effect, accuse Lieut. Bell of pilfering from Mr. Shaw an invention which he afterwards patented. It was the purpose of "Justice," in his reply to that publication, to repel this foul aspersion, and that purpose was effectually accomplished by reference to dates and documents which are incontrovertible. This point has not been touched, nor even approached, in any of the discursive wanderings of this enormous rejoinder, and hence it is regarded as being wholly abandoned by Mr. Shaw. Here we might rest the matter, and would do so, but for a denial on a collateral point which requires a brief notice.

"Justice" stated that it was a matter of official record, that the principle of applying percussion locks and primers to the firing of cannon, had been suggested to Mr. Shaw by another more than eight years before that time, (April 1831.) This statement is met by a positive denial, and "*Justice*" is thereby accused of falsehood. Mr. Shaw says, "if it be on official record that this invention of mine was communicated to me more than eight years ago, what ignorant individuals must preside," &c. after which he comes directly to the point, and says, "I deny that information was ever conveyed to me from any quarter, that furnished *any*, even the most distant hints of my invention." And then refers to certain experiments made at Frankford, November 20, 1823, in support of that denial. This date is the earliest quoted by Mr. Shaw. Now, let him be asked, if he will dare to deny that these very experiments which he here cites as the foundation and the sustaining prop of all his claims, were not made in pursuance of suggestions communicated to him by another a long while before? Let the following extract from an "official record," answer.

Extract of a letter to J. Shaw, of Philadelphia, dated 12th February, 1823.

"It is contemplated to make some trials in the application of the detonating powder to cannons by means of a lock to be prepared for that purpose, and to be permanently attached to the gun. I have to request that you will prepare a few primings for this purpose. I conceive that the copper caps should be much larger for cannon, than those for small arms, and they should contain about three times the quantity of powder. The primings for cannon must necessarily be much stronger, because the fire must be transmitted a much greater distance, (say six or eight inches,) and must penetrate the flannel bag which contains the powder. These circumstances should be taken into consideration, and provided for, in preparing the primings. It will be necesary also, that the lock should be proportionably strong, which will be attended to when made."

It should be borne in mind that this letter was written at a time when the application of detonating powder and percussion locks to the firing of *small arms* was well known and in general use. The

application of the same principle to the firing of *cannon* was first suggested in that letter; or, it is at least the first known to the writer; if there be any of earlier date, let it be shown by Mr. Shaw.

JUSTICE.

April, 1832.

Note by the Editor.—The note to which our correspondent alludes will be found at page 159 of our last volume. It was then supposed that if any rejoinder was offered to the remarks of Mr. Shaw, it would immediately have followed the publication of his article; the removal to a distant part of the Union of the gentleman who writes under the signature of *Justice*, prevented his seeing Mr. Shaw's last communication, and has consequently delayed the appearance of *this final* notice.

Decision of the Supreme Court of the United States, in a case involving the question of the Validity of a Patent, which has been surrendered and reissued on an Amended Specification.

It has been the practice in the Patent Office to allow a patentee to surrender his patent, in order to allow of his amending a specification which through inadvertence, or a want of information respecting the requirements of the law, had been defective; the reissued patent, in such cases, always bearing the same date with the original patent. No formal decision, however, had taken place in the courts of the United States, establishing the correctness of this procedure, in regard to which the law itself had not made any provision. This question has been finally settled at the recent term of the Supreme Court.

The case which brought this question before the court was that of E. & H. Raymond *versus* Grant & Townsend.

This was an action to recover damages for an infringement of the right of the plaintiff, Joseph Grant, under a patent granted in April, 1825, a former patent for the same thing having issued in August, 1821, but which having been surrendered owing to a defective specification, had been cancelled of record, and the second issued to continue for fourteen years from the date of the first.

One of the pleas filed by the defendants was that the specification did not correctly and accurately describe the improvement claimed, that it did not furnish any account of the sizes or proportions of the respective parts of the machine, nor describe its manner of operating in those full, clear, and exact terms required by the law. The plaintiffs, in reply, aver that neither their description, or the drawings annexed thereto, are in any way deficient.

On the trial, the counsel for the defendants objected that the Secretary of State had no power by law to accept a surrender of, and to cancel, said letters patent. The court, however, decided that such surrender might be made, when the defect arose from inadvertence

or mistake, and without any intention of fraud on the part of the patentee. To which decision the counsel for the defendants excepted.

After adducing testimony, the counsel for the defendants moved the court to instruct the jury that if the specification was proved to be defective, that they must find for the defendants; which instructions the court refused to give, but instructed the jury that the patent would not be void on account of such defect, unless it arose from design, and for the purpose of deceiving the public. To this opinion the counsel also excepted.

The jury found a verdict for the plaintiffs, and assessed the damages to $3266 66, the judgment on which was brought before the Supreme Court, by a writ of error.

In giving its decision in this case, it was observed by the court, that "the first question in the cause, respects the power of the Secretary of State to receive a surrender of a patent, and to reissue it under an amended specification for the unexpired part of the term. The court was of opinion that although the law did not make any direct provision allowing of such a surrender, and the reissuing of a patent under an amended specification, yet such a proceeding seemed to accord with its general spirit. That the public still obtained every thing which was intended to be secured to it; and that the sense of justice and of right which all feel pleads strongly against depriving the inventor of the compensation solemnly promised to him, because he has committed an inadvertence, or innocent mistake. Every one, it was observed, would acknowledge the propriety of issuing a new patent, if an error had been committed in the Department of State, yet this would be done without any thing in the law to authorize it; and why should not the same step be taken for the same purpose, if the mistake has been innocently committed by the inventor himself? The executive department, it is understood, have acted upon the construction adopted by the Circuit Court, and have considered it as settled. We would not willingly disregard the settled practice in a case where we are not satisfied it is contrary to law, and where we are satisfied that it is required by justice and good faith."

This is the only point involved in this case which we deem it necessary to lay before our readers at present, as we shall hereafter republish in this journal our Digest of the Decisions of the United States in Cases arising under the Patent Laws, made by order of Congress, and published with the general list of patents. When we do this, we shall append thereto such further information and remarks, as subsequent decisions, and the amendments which may be made to the patent laws, may render necessary.

EDITOR.

Bibliographical Notices.

Lardner's Cabinet Cyclopædia.

Hydrostatics and Pneumatics, by the Rev. Dionysius Lardner, with Notes by Benjamin F. Joslin, M.D., Professor of Natural Philosophy in Union College. First Am. from 1st Lond. Ed. Carey & Lea. 1832.*

This is the thirteenth number of the excellent series of treatises comprised in the Cabinet Cyclopædia, the republication of which in this country we owe to Messrs. Carey and Lea. If called upon to state our preference of one or other of the two treatises on Natural Philosophy, namely, of the Mechanics or of the Hydrostatics, we should pronounce in favour of this latter work. The style is more popular throughout. Each step in the subject is explained by reference to a supposed experiment, and thus the reader has before him a representation of precisely what the author means to convey by his proposition. The mind is in this way led forward from the consideration of the more simple truths to the complex phenomena of both Hydrostatics and Pneumatics.

When so much depends upon the figures illustrative of the text, it is to be regretted that the publishers have given such inferior cuts: we have rarely seen worse specimens of the art than some of them afford. The models from which they were taken in the English work are not remarkable for either great accuracy or elegance, but in the latter quality, if not in the former, they surpass the American copies.

The publishers have taken the pains to secure an editor for the American edition of this work. In running over the text we observe that many errors of inadvertency in the English edition are corrected, and some which can hardly admit of the application of so mild a name, pointed out in the notes at the foot of the page. We could have wished that whenever the author was certainly wrong the American editor had altered the text without involving the reader in any discussion, permitting him thus to suppose that there could be two views taken of the subject. The American editor has taken this course in the tables pages 217 and 218, which were altogether incorrect in the English edition, and which are made accurate in this, (if we except one typographical error,) without noticing the change.

It would be but an ungrateful task to point out trivial errors in the figures and text which remain uncorrected, and having holes in our own coats requiring mending, we would be chary in pointing out those in the garments of our neighbours. We will even resist a disposition to criticise the sphere said (page 15) to have a bottom, a top, and sides, which has escaped the eye of the American editor, and the contracted vein (fig. 68) with *diverging* sides.

Such errors speak for themselves, and throw but little impediment

* Com. Pub.

in the way of a clear sighted reader. The readers of our journal would probably include in this class also the sixty pounds pressure upon a square inch, which they are told (page 37) by Dr. Lardner "considerably exceeds that which is produced in most high pressure steam engines." There are inaccuracies, some of which, as calculated to impress erroneous conclusions upon readers, we will notice.

First, then, the remarks on page 85, where, as the basis of reasoning, is assumed what is now known not to be true, that salt water has a point of maximum density. To be more explicit, that at a certain temperature, salt water is denser than at either higher or lower temperatures. The remarks of Dr. Lardner are very philosophic as applied to collections of fresh water, the limited depth of which renders the provision of which he speaks of immense importance.

Such is not the case in regard to the ocean, of which the great depth, and the interchange of the cold and dense waters of the polar seas, with the warmer and lighter waters of the equatorial regions, prevent any very considerable reductions of temperature. The anomalous action is not needed in the ocean, and there we do *not* find it.

We object also to the idea that "*pure*" mercury (page 196) can be obtained by straining the impure metal through chamois leather, and that no other purification is required to rid the metal of the "*solid*" substances which it takes up. If alloyed with lead, tin, or bismuth, which would materially affect the specific gravity of the metal, and therefore its use in the barometer, the straining through chamois leather would not remove the impurities, and recourse must be had to the action of dilute sulphuric acid and to distillation.

In the preparation of calomel much distilled mercury is obtained which allows it to be sold at a lower price than if the process of distillation had been resorted to expressly to procure the metal. It is much to be wished that this pure mercury were substituted in the barometer especially, but also in the thermometer, for the ordinary mercury employed.

The theory of the lifting pump, given page 239, is strangely incorrect. The author supposes the piston of the pump to be loaded in making the upward stroke with a column of water, having for its height the distance from the valve in the piston to the level of the water in the pump. That this cannot be the case is readily seen, since the water in the cistern would certainly rise to its level within the body of the pump. The piston of the pump is urged *upwards* by a force due to a column of water between the piston and the level of the fluid in the cistern, it is urged *downwards* by the column stated by Dr. Lardner, and hence the resulting downward pressure is the column between the level of the fluid in the cistern, and the level of that in the pump.

On the very next page, (240,) we find a pump with a solid plunger classed as a "lifting pump," though the action of the machine *forces* water which has risen into the barrel of the pump in the upward stroke of the plunger, by the downward stroke, into an adjacent tube having a valve at the bottom. The pump is, in few words, a peculiar form of the forcing pump, with a solid plunger.

These few remarks will, we trust, be turned to account in a second edition, by drawing the attention of the American editor more particularly to the fact that errors do really exist in the work, besides those which he has corrected.

Meanwhile we would recommend those who are fond of such reading, to procure the book without fear that the inaccuracies will weigh a feather when compared with its merits. B.

AMERICAN PATENTS.

LIST OF AMERICAN PATENTS WHICH ISSUED IN NOVEMBER, 1831.

With Remarks and Exemplifications, by the Editor.

1. For an improvement in the *Tanning Apparatus;* William Brown, Mooresville, Delaware county, New York, November 2.

The present patent is taken out as an improvement on the apparatus patented by the same gentleman, November 11th, 1830, and consists in a method of removing the refuse bark from the letches without the ordinary labour of shovelling. Those who are interested may refer to our account of the original patent.

There is to be a plug passing through the false bottom, and fitting closely into the true bottom of the letch, closing an opening through which its contents may be discharged. When this is to be effected the letch is filled with water from the reservoir, the contents are then agitated so as completely to stir up the spent bark, when, on withdrawing the plug, the bark and water will run out together through a trunk fixed for that purpose.

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2. For an improved *Wheel for a Rail-road Car;* Samuel Krauser, Reading, Bucks county, Pennsylvania, November 2.

We have here another edition, *without improvements*, of Garnett's friction rollers. These rollers, or wheels, are to be connected together by a ring through which their axes pass; between these the axle of the car is to work, whilst they fit within the rim of the main wheel, which forms a box to receive them.

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3. For a *Tri-cylinder Machine, operating by Water fall;* Eugene Berganzio, city of New York, November 2.

We begin with the end of the specification of this machine, which although it is not in the form of a claim, assures us of the great value of the invention, by informing us that "two horses will consequently produce the power of twelve." After this, if it is expected that we shall give a particular description of the machine, that expectation will be disappointed. All we shall say is, that two horses, walking in a hollow drum, are to raise water enough, in buckets, to drive a water wheel which shall have the power of twelve horses.

We would suggest an improvement to the patentee, which is, either to shoot, or otherwise dispose of, his horses, as soon as he has

fairly set his machine to work, as the water raised by them will still leave the power of ten horses, every two of which may be made to operate upon a machine similar to his first, and thus produce the power of sixty horses, the principle being, of course, applicable *ad infinitum.*

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4. For a *Machine for Drilling or Boring Stone;* William Holdridge, city of Albany, New York, November 2.

Drills, made in the form usually employed for the above purpose, have their shafts passing up through holes in guide pieces, which retain them in their vertical position. The shafts are attached to spring poles, which serve to raise them; and by means of a rope descending from each pole the shaft attached to it is worked up and down. These parts, with a frame to sustain them, constitute the whole machine, no provision whatever being made for the necessary operation of turning the drill as the strokes are repeated. There is no claim made, excepting to the using of any number of drills, and to the making the machine of any size, shape, or material best adapted to it; a right which will not be disputed.

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5. For an improvement in the *Manufacturing of Axes;* Erastus Shaw, and Robert H. Burk, Canton, Hartford county, Connecticut, November 3.

Rollers are to be prepared and geared in the manner of flatting mill rollers; one of these is to be indented; and the other is to have a raised part upon it, leaving, between the two, a proper space for the formation of the axe, so that when bent over, the eye and other parts will have their proper shape. The iron, properly heated, is to be passed between these rollers, and when delivered from them subjected to the action of a press, provided with a punch, or follower, for bending the parts together.

The claim is to the forming the parts of axes by means of rollers, and of doubling them together in a press.

The description is equally general with our notice of it, "the *particular* form of machinery used to carry these principles into operation being deemed unessential." We, however, do not concur with the patentee on this point, for the *general principle* of such a machine is well known, numerous articles having been manufactured of iron by means of rollers; we apprehend, therefore, that to sustain a patent for such a purpose, there ought to be something *special* in the construction of the apparatus, and that such special contrivance should be clearly exhibited.

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6. For a *Composition to be used in the Stiffening of Hats;* Charles Bent, and Francis Bush, Chelmsford, Middlesex county, Massachusetts, November 3.

The materials to be employed in forming an elastic, water-proof stiffening for hats, are borax, rosin, shellac, and copal. Eight ounces of the first, one pound of the second, two of the third, and five ounces

of the last, are to be dissolved in five quarts of hot water, the ingredients being put into it in the order stated. The hat bodies are to be saturated with this compound, and then trenchered, leaving the larger portion of the stiffening in the brim. After standing half an hour they are to be put into a weak solution of sulphuric acid, and then soaked in cold water until all the acid is removed, when they are ready for napping.

The patentees state that this process is much cheaper and better than those usually followed, and that by its aid a workman can stiffen three times the number that can be stiffened by the usual method.

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7. For a composition of matter for the *Cure of the Gout and Rheumatism;* William A. Parker, Bellhaven, Accomack county, Virginia, November 4.

This composition of matter is called "Parker's compound vegetable spirit," which is to be extracted from sassafras root and ground ivy. A still is to be filled with "as much of the root," clear water, and about five pounds of ground ivy to the hundred gallons. This is to be boiled for about thirty minutes, removing the scum which rises. About ten gallons are then to be distilled over for every hundred in the still, and when one-sixteenth of 5th proof brandy is added, this spirituous composition of matter is fit for use, and the patient is to take a wine glass full, two or three times a day.

We have no doubt that the foregoing is quite as harmless and as useful as the generality of quack medicines; one thing is certain, its active properties reside in the fifth proof brandy, and so far as grog, or weak toddy is an antidote to gout and rheumatism, the receipt of *Dr.* Parker must be good. We, however, should agree with the members of the temperance society in the opinion that the smaller the dose, the better.

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8. For an improvement in the *Tanning of Leather;* Abraham Conwell, Connersville, Fayette county, Indiana, November 4.

There are to be tubes of communication between each of the vats employed, which are opened or closed at pleasure by means of cocks fixed within the strainers, or leach eyes, and also with a cistern which forms a common reservoir from each of them. The claim is to "the application of the conductors and pipes to the vats, by means of which much labour and bark are saved in the business of tanning." Conductors and pipes have been repeatedly used; we have seen them many years since; not precisely as described by the present patentee, but operating upon the same principle, and answering the same end.

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9. For a machine for *Thrashing Grain,* and cleaning it from smut; Henry Spencer, Maryland, Otsego county, New York, November 7.

The cylinder of this machine is to be of solid wood, one foot in diameter, with beaters upon it, which are also to be of wood, and to consist of pieces one foot in length, and one and a half inch in di-

ameter. In an ordinary sized machine there will be forty-eight of these beaters, standing at right angles to the cylinder, and set so as to form a spiral line round it. The concaves, feeders, &c. vary but little from those commonly used, and we are not told in what the improvement consists, there being no claim.

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10. For an improvement in the *Manner of straightening the Toggle Joint in the Hand Printing Press;* Otis Tufts, Boston, Massachusetts, November 7.

The combination of levers and joints shown in the drawing which accompany this specification, constitutes the claim to a patent; a good idea of this cannot be given in words alone, and we therefore omit the form of the claim. We have had occasion, more than once, to describe variations in this particular apparatus; the relative merits of the different plans cannot be otherwise settled than by direct experience.

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11. For an improvement in the mode of manufacturing *Mattresses, Sofas, and other articles;* Rowland Cromelien, city of New York, November 7.

The mattress here claimed is as nearly like that described at page 128, patented by Mr. French on the 25th of August, as one mattress can well be like another; and if claims can be sustained for differences so small, every man may readily become an inventor, and secure his invention by patent. To the public, however, this will be a point of little importance, provided they obtain a good article, and do not pay any thing for the pretended improvement.

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12. For a process by which the *Borings, Drillings, Filings, or Turnings of Cast Iron are rendered available in the Furnace;* Magradier Mason, Georgetown, District of Columbia, November 8.

(See specification.)

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13. For an improved *Rotary Steam Engine, or Pump;* Oliver Allen, Norwich, Norwich county, Connecticut, November 8.

The attempts at rotary steam engines have been so numerous, that it is scarcely to be expected that any other than new modifications, and methods of obviating the difficulties which have attended their use, should be now brought forward. The present engine, in its general structure, resembles others which have been previously patented, and this is stated by the patentee. There is to be a revolving drum, with a stationary head. Valves are opened and closed by a circular guide piece, so curved as to effect this object in the desired manner. One of the improvements proposed is the making depressions in the head of the revolving drum, or cylinder, over which depressions the edges of the valves pass; these allow the steam to escape at the moment the valve begins to rise, and thus relieve it from the pressure which would impede its opening. Another part claimed as

an improvement is the employment of three cocks in a steam box, the keys of which cocks are geared together, so that one lever acts upon the whole; these cocks serve to cut the steam off, or to admit it at either of two openings, so as to stop or reverse the motion of the engine. The following claim notices these and other parts viewed as new. "1st. The manner of fixing and adjusting the circular guide plate for opening and closing the valves. 2nd. The excavations made in the fixed head for relieving the valves from the pressure of the steam before they commence rising. 3d. The mode of giving a lateral adjustment to the cylinder by means of the circular plates inserted into the ends of the casing, and which bear upon the shoulders of the shaft. 4th. The employment of, and the manner of fixing the three cocks for the admission and discharge of steam, when used as a steam engine. 5th. The packing in the grooves of the fixed head, by means of circular metallic rings, borne up by elastic packing, or by springs."

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14. For an improvement in the *Apparatus used for heating Hatters' Irons;* Daniel L. Tuthill, city of New York, November 8.

This furnace is very simple in its structure, and is to be made wholly of metal. The fire place is a cylinder of eight inches in height, and the same in diameter, with a grate at the lower end, and two bars above to support the irons, being exactly like the common cast iron furnaces. The cylinder is to be placed in an iron box, or oven, like that of a common cooking stove, having a hole through its bottom to allow the cylinder to pass through, until it rests upon a rim, or flanch, surrounding its upper edge. The oven is closed by a door, and has a pipe leading from the top, and furnished with a damper to regulate the draft.

The claim is to "the general construction and *application* of the furnace above specified, for the *above mentioned purposes.*"

The *general* construction has certainly but little of novelty in it, nor do we think it very good. The furnace part, if made of clay, brick, or other bad conductor, would be more economical, and less annoying in warm weather. As to the "*application*" to the "*above mentioned purpose*," we apprehend that if the tailor may heat his goose, and the laundress her flat irons, at such a furnace, the hatter may take the same liberty, either with or without a patent therefor.

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15. For an improvement in forming the *Pavement of Streets,* for which a patent issued to John L. Sullivan, Engineer, of New York city, on the 20th of October, 1831, which patent has been surrendered and cancelled on account of a defective specification, and reissued November 9.

The principal difference between the present and former specification consists in the drawing up of the new one with much greater precision than the former, and in the direct mentioning that instead of finishing with the water cement, the patentee sometimes, after the

lower stratum of water cement is dry, fills the upper part of the interstices with fusible mineral cement, applied boiling hot, forcing fragments between the stones, as in the former instance.

For our notice of this patent when first issued, we refer to p. 236, in the number for last month.

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16. For a *Thrashing Machine;* Johnson Dawkins, Westport, Oldham county, Kentucky, November 10.

This machine operates by means of flails fixed in rows upon each side of a thrashing floor. The thrashing floor is an inclined plane down which the article to be thrashed is made to pass, the flails operating upon it in its descent. The floor is formed of slats which allow the grain to pass through on to a spout which conducts it down to a winnowing machine. The wheel work and levers by which the flails are to be moved, are placed under the inclined floor.

The claim is to "the before described machine, but particularly the vibrating frames of flails or beaters; the mode in which they are vibrated; the inclined floor, and the openings and spouts for conveying the grain to the winnowing machine."

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17. For *Looking glass back ground to Pictures or other Ornaments;* Isaiah Jennings, city of New York, November 11. (See specification.)

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18. For a process for *Dying Cotton in the Staple, or Cotton Wool;* James Roy Stewart, Lowell, Middlesex county, Massachusetts, an alien who has resided two years in the United States, November 11.

The object of this patent is to prepare the cotton wool for entering into the composition of cloths of mixed colours. When the cotton has been carded, the laps, or sheets, as they are delivered from the machine, are to be loosely folded so as to bring the extremities nearly together; they are then to be placed between coarse sheets, or secured in any similar way, allowing the contact of water; the cotton thus secured is to be boiled in water for about four hours; the laps are then to be dyed in the manner in which yarn is usually dyed; the boiling, it is said, will prevent all shrinking and matting in the process of dying, and thus remove the difficulty which has heretofore existed in preparing it to be used in mixed cloths.

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19. For a *Machine for Mixing Mortar;* Andrew Kirkpatrick, Urbana, Champaign county, Ohio, November 12.

This machine is designed for mixing mortar for bricklayers, or clay for potters. Two vertical shafts are made to revolve in an oblong tub, with circular ends; the shafts have knives, or breakers, passing through them, which, by their revolution, divide and mix the materials; the knives of one shaft are so fixed as to pass between those of the other. There is to be a hopper above the tub into which the materials are to be placed, and under this a seive, and trough, or chute;

the cog wheel by which the shafts are made to turn, is furnished with cams which agitate the seive. The tub is to contain water, and as the materials fall into this, the revolving knives, or breakers, agitate and mix them.

The claim is to "the foregoing machine, particularly the vertical shafts containing the knives or breakers, and the cams on the double faced cog wheel for shaking the riddle."

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20. For *Elliptical Steel Springs for Carriages;* Charles Hinkle, Northampton Township, Lehigh county, Pennsylvania, November 12.

This elliptical steel spring is, in form, the double bow spring, which we see in use every day, and many times a day. The only *novelty* appears to be that each bow is to be a single plate of steel, instead of several plates one upon the other. "The *invention* here claimed is in making steel springs for carriages of two plates of steel bent to any curve, placed upon each other, and fastened at their ends by lapping, and with rivets, or bolts, and thus forming elliptical springs."

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21. For an improvement in the *Machine for Spinning Cotton or Wool;* Levi Rice, Milburn, Somerset county, Maine, November 14.

It appears, judging from the drawing, if such it may be called, that this is intended as a domestic spinning machine, as it is represented as carrying eight spindles only. The band which drives the spindles appears as though it pressed against their whirls, which it is made to embrace by being carried round a roller between each spindle, *a*, *a*, *a*, being the spindles, and *b*, *b*, *b*, the rollers, which are, we suppose, what are designated friction wheels by the patentee. He claims "the putting any number of spindles in motion by one band, by the improvement of the friction rollers, consequently the yarn or thread on each spindle is twisted exactly even, or alike, which cannot be done with a band to each spindle."

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22. For a *Machine for Planing and Dressing Boards,* &c. John W. Newberry, Avon, Livingston county, New York, November 15.

The plane used in this machine has cutting irons fixed in the ordinary manner; but, being intended to cut by its motion in both directions, it has two irons which have inclinations the reverse of each other. The stock has two faces, the planes of which form an obtuse angle at their union in its middle. The plane is made to tilt as it passes backward and forward, so as alternately to bring each face, and cutting iron, on to the board or plank. There is a frame work above with cog wheels, and a rack and pinion, with their necessary appendages for working the sliding frame with the plane, back and forth. There are also proper contrivances for holding the board;

the whole of these are well represented in the drawing which accompanies the specification, to which there are ample references.

There is no claim made, and as the machine is not similar to any other for the same purpose with which we are acquainted, this may not be of any importance.

From its structure, it appears to be calculated for short stuff only, and we think it too complex for general use, even for such stuff. In the greater number of cases, a plane of the ordinary construction, especially in roughing out, will tear the stuff in working in one direction, and indeed, the cases are rare in which even a smoothing plane may be used indifferently either way. This objection must lie against most of the planing machines in which the cutting is not done in a curve.

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23. For a *Self-regulating or Self-directing Rail-road Car;* Lewis Wernwag, Harper's Ferry, Jefferson county, Virginia, November 15.

This car is to have four wheels fixed in the usual way, and half way between these there is to be another pair of wheels of smaller diameter, which last, are the regulating, or guiding wheels. The fore and hind axles run in frames connected together by coupling poles, like those of a common wagon, but of equal length, so as to meet in the centre. The guiding wheels are to operate upon the coupling poles at their point of junction, forcing them laterally, according to the curvature of the road. In the drawing, these guiding wheels are represented as about four-fifths of the diameter of the main wheels. They are connected together by means of a slender iron axle, which has its main bearing in a box at its centre; there are shoulders upon the axle by which it is made to act upon the poles which are connected with the box, or bearing. The guiding wheels are furnished with flanches, like the main wheels, and when the road is curved, these flanches, touching against the edges of the rails, cause the ends of the coupling pole to keep in the centre between the two rails.

There is a jointed lever attached to each side of the carriage, furnished with boxes to receive the axle of the regulating wheels, in order to steady it, whilst they allow it to slide freely endwise.

The claim is to the described method of making rail-road carriages with self-directing wheels and axles, however applied.

Where a road is considerably curved, the vertical edge of the flanch of the guide wheel, acting upon the vertical edge of the iron rail, will occasion much rubbing friction, which will cause them to wear with considerable rapidity. Should this objection prove to be of little moment, the principle upon which they act is undoubtedly good.

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24. For a *Thrashing Machine;* Philip Shaffer, Richmond Township, Bucks county, Pennsylvania, November 16.

"The improvement claimed is the fixing the iron pins, or pick-

ers, firmly in the bars placed on the cylinder, and the removing of one piece of the cast iron bed, and substituting the board to preserve the straw."

The machine is, generally, like its neighbours; some of which, we presume, have the iron teeth fixed *firmly*—at all events, the present patentee does not indicate any new way of doing this. His mode of preserving the straw untangled, we do not quite understand. He says, however, that it is effected by removing a part of the cast iron bed, or curve, under the cylinder, and placing a board to receive and guide the straw.

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25. For *Combined Grist and Saw Mills;* Noah Porter, Boston, Massachusetts, November 17.

The shafts of circular saws, and the spindles of grist mills are to be driven by pinions geared into the same horizontal spur wheel. There are, of course, the necessary fixtures for performing the required operations, but these do not present any thing in the slightest degree new. The patentee appears to be of a similar opinion, as he claims "the general arrangement of the before described combined grist and saw mills, and the mode of throwing the saw mill in and out of gear by the levers, or elevators."

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26. For a machine for *Washing and Wringing Clothes, and for Heating Water;* James Luckey, Troy, Rensellaer county, New York, November 19.

This machine consists of an oblong box, divided into three compartments, in one of which the water is to be heated; the clothes are to be washed in the second, and wrung in the third. A furnace of metal is to be let into one of the compartments of the box, and is to be secured to it by the aid of a flanch. The water in this compartment surrounds the furnace, the smoke being conducted off through a pipe rising from the back end of the furnace. The washing compartment, which is in the centre, is about twenty inches square; in this is to be placed a fluted rubbing board, on the ordinary construction; a rubber, consisting of two or three rollers held in the hand, by means of its frame and handle, is to be passed over the clothes held upon the rubbing board.

The wringing compartment, which is at one end, contains a strong netting, or coarse cloth, attached to a shaft which may be turned by a handle or crank. The clothes to be rinced are placed in this cloth, or netting, and on turning the shaft, by means of the handle, they are twisted round it and the water squeezed out of them.

The claim is to the mode of heating the water; the apparatus for wringing; the rubber, and the general arrangement of the several parts.

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27. For an improvement in the *Machine for polishing and graining, or dicing Morocco, or other Leather;* patented on the

20th of April, 1831; Robert Emes, Boston, Massachusetts, November 21, 1831.

We gave an account of this machine when first patented, which will be found at page 164 of the last volume, with a reference to some machines for the same purpose previously patented. The present specification describes the whole machine, without designating the parts which constitute the improvement. The patentee observes, that by comparing the present specification and drawing with the former, it will be found that there are parts not described in the original, and that these constitute the improvements which he now claims. We do not think that it ought to be left to others to discover what a man patents, but that he should clearly point out in what his claim consists. Two machines which are essentially alike in principle, may differ in a way which would not become the proper subject of a patent. It may, for example, be found necessary to brace a machine more effectually, or to make some part of it stronger than was at first done, and these alterations might constitute real improvements in one sense of the word, although not in another. The patentee should tell us, therefore, whether his improvements extend to the mere fact of arrangement, or include what may be called a new principle, or mode of action, and in what part this new principle, or mode of action, is to be found.

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28. For an improvement in the mode of *Scouring, Smoothing, Burnishing, &c. all kinds of Tanned Skins*, or Leather; Robert Emes, Boston, Massachusetts, November 21.

This machine is intended to perform several operations in the leather manufacture which have hitherto been performed by hand, such as scouring, cleansing, striking out, putting out, smoothing, brushing, dressing, and finishing. The present machine is precisely similar in its general construction to that referred to in the last article, but it is made to carry brushes, sleckers, and substances covered with cloth or felt, adapting it to the performance of the operations above enumerated; these occupy the place of the flint, or other polishers, used in polishing, graining or dicing.

The claim made is not to the brushes, &c. but to the mode of using them by means of the machinery described; the brushes and other instruments attached to the wheel, or revolving arms, being similar to those ordinarily used in the hand.

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29. For an improvement in the *Bedstead* called the "Metamorphoric Alleviator," for which a patent was obtained on the 25th of October, 1830; Jonathan Lowe, Whitesborough, Oneida county, New York, November 21.

The bedstead, it appears, remains essentially the same as under the former patent, but the elevating process, which was originally performed by means of rollers, cords, and pulleys, moved by a crank, is effected, in the improved bedstead, by wheels and axles, using either straps, cords, or chains, or other means of fastening them to-

gether, and pinions, ratchets, segments, or other means of changing the position.

All this, it is true, is rather indefinite, but for this we are not answerable, the defect being in the specification.

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30. For a *Chemical Water Proof Cement* for preserving brick and wood work from the injurious effects of water; Charles Fletcher, Boston, Massachusetts, November 22.

The composition here prescribed is a mixture of three quarts of hydraulic cement, two of calcined plaster of Paris, one of unslaked lime, ground; a quarter of a pound of copperas, pulverized; and half a pound of litharge, or red lead. The plaster, we are told, must be calcined in an air tight vessel, and when the above ingredients are mixed together, there must be added half a gallon of boiled linseed oil, the same quantity of spirits of turpentine, and a gill of sour ale or beer. These ingredients are to remain together for two or three days; they are then to be ground, and after being brought to a proper consistence by adding equal parts of boiled oil and turpentine, the work is to be covered with two or three coats of the mixture, laid on by a brush. When a darker shade is wanted, Roman cement is to be added until the desired colour is obtained.

There is no claim made, and, of course, the patent is restricted to the composition exactly as described, a composition which, if it possess the good qualities ascribed to it, may be varied, not only without injury, but probably to advantage.

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31. For a *Thrashing Machine;* Waldren Beach, city of Philadelphia, Pennsylvania, November 23.

A cylinder is to revolve within a curve, and the other parts of this machine strongly resemble such as we have often described; the so called improvements are not of that striking or tangible character as to require particular notice, as they consist mainly in the method of putting the machine together.

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32. For an improvement in *Saw Mills;* Rufus Eaton, Concord, Erie county, New York, November 24.

This machine exhibits a very complex combination of wheels, pinions, and racks, for moving a carriage which supports a circular saw for sawing timber. The improvement particularly claimed is the moving the frame which carries the saw, instead of moving the timber in the usual way.

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33. For a *Cure for Dropsy and Epilepsy;* John S. Fall, Rattlesnake Spring, Morgan county, Georgia, November 25.

The plan of treatment designated in this patent, will, we are told, cure anasarca, ascites, hydrothorax, pericardial dropsy, dropsy of the scrotum, and hydrocephalus internus, producing in adults epileptic affections and mental derangement.

In the first place a tea is to be made by boiling an ounce of Sene-

ca snake root for an hour in a quantity of water, sufficient to make a quart. In this an ounce of saltpetre is to be dissolved; two ounces of this tea is a dose.

A pint of tea is to be made by boiling three drachms of purple foxglove in water. Of this half an ounce is a dose.

After administering aperient medicine, if necessary, a dose of each of the teas is to be given alternately every hour for ten hours in succession, for two or three days; they are then remitted for a day and a half, and resumed, but not continued as long as at first. Pills of one and a half grains of calomel are then to be given morning and night, until slight ptyalism is produced, soon after which the teas are to be resumed, which third course of the teas is generally sufficient for the cure. In case of debility, tonics are to be administered. Should the cure not be completed by the first course, it is to be resumed, and carried to the necessary extent.

We do not know whether the patentee writes M. D.; his specification, however, is drawn up with much more intelligence than those in general which relate to quack medicines, or empirical practice. Whatever of fame or wealth he may acquire by the use of his patent, we doubt, very much, his growing rich by the sale of rights to practising physicians.

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34. For an improvement in *Coach Steps;* George Carter, Newark, Essex county, New Jersey, November 26.

The specification of this patent consists of eighteen words only, communicating the information that the improved coach steps are to be made of malleable cast iron.

Should the validity of this patent be tested in a court of law, the gentlemen of the bar would not, we apprehend, imitate the brevity of the specification; and it might, as has been frequently the case, be found much more easy to claim than to hold a thing. The manufacture of malleable cast iron has, in England, during the last ten or twelve years, embraced the greater number of articles which were formerly made of wrought iron, and, according to the assumption in this, and similar patents, every kind of article so made might have been patented. The *process*, when new, was a proper subject for a patent, but not the individual articles subjected to it.

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35. For a *Machine for Painting Cloth;* Otis Ferrin, Lansingburg, Rensselaer county, New York, November 28.

This machine is in the form of a trough, or hopper, which is to contain the paint. Its bottom consists of a straight piece of timber, covered with leather; one side of the trough, which is called the knife, consists of a board sliding in grooves, and borne down by springs, in order that its lower edge may press upon the cloth as it is drawn through. A roller, on each side of the piece which forms the bottom of the trough, supports the cloth; a stick is attached to the end of the cloth, and to this stick ropes are fastened, leading to a windlass, situated at the distance of the length of the piece; this windlass serv-

ing to wind the ropes, and draw the cloth along. The parts claimed are the inclined board, forming one side of the trough, the springs, and the rollers.

Specifications of American Patents.

Specification of a patent for rendering Borings, Filings, &c. of Iron, available in the Furnace. Granted to Magnadier Mason, *Georgetown, District of Columbia, November* 8, 1831.

I take the borings, drillings, filings, or turnings, and subject them to the action of a powerful press, or to repeated blows from a tilt hammer, drop press, ram, or to the action of any of the well known machines or instruments by which the particles may be forced together and made to adhere, so as to form lumps partially consolidated. In doing this, every competent workman will be aware that the particles to be acted upon must be confined in a box, or mould, to prevent their being scattered by the pressure, or the blow, to which they are to be subjected. The lumps, or masses, of iron so formed, are placed in a furnace, and treated in the same way in which pig or other iron is treated when it is to be fused, or rendered available.

What I claim as my invention, or discovery, is the bringing the particles of iron which are produced in boring, drilling, filing, or turning, into lumps, or masses, by subjecting them to the action of any machine, or instrument, calculated to effect that object, and thus bringing them into a state from which they can be readily fused, or rendered available, as hereinbefore set forth.

Magnadier Mason.

Specification of a patent for Looking Glass Back Grounds to Pictures or other Ornaments. Granted to Isaiah Jennings, *city of New York, November* 11, 1831.

To all whom it may concern, be it known, that I, Isaiah Jennings, of the city of New York, have invented a new and useful mode of forming back grounds to pictures, and ornaments of various kinds, which I call the looking glass ground, and that the following is a full and exact description of my said invention.

The end to be attained is the formation of an aerial back ground to pictures and other ornamental articles, by which they receive an appearance of more perfect relief than by any mode of procedure hitherto known. This I effect in different ways, but all intended to give a looking glass back ground to the picture or ornament. I sometimes take a plate of glass which has not been silvered, and I draw upon it such portrait, picture, ornament, or device, as may be desired, in one or more colours; or I stain or enamel the same upon the glass, and after such picture or device is finished, I proceed to silver the glass, on the same side with the picture or device, in the ordinary

way of silvering looking glasses. Or, instead of silvering the glass upon which the picture or device is painted, I place behind it a plate of looking glass, securing the two glasses in any suitable frame, the painting, or device, inwards.

When the picture or device is formed upon paper, or any other material which can be cut out, I carefully cut the said picture or device from its ground, and then lay the ground upon the silvered side of a looking glass, and trace the outline of the picture or device thereon, through the silvering. I then remove the silvering within the said tracing, and apply the picture or device in the space thus formed, securing it by a suitable backboard, or otherwise. Or I place the said picture or device between a plain and silvered glass, which produces the same effect as the foregoing.

At other times I trace the outline, and remove the silvering, as in the last example, and then paint the desired picture or device upon the glass. In either of these modes of procedure a similar effect is produced.

What I claim as my invention is the forming a back ground of looking glass to pictures and ornaments of various kinds, upon the principle, and producing the effect herein described, whether the same be done by either of the modes hereinbefore mentioned, or in any other accomplishing the same object.

ISAIAH JENNINGS.

On the Strength and Best Forms of Cast Iron Beams.

[Continued from p. 271.]

Experiment 11. Beam from model of experiment 9, the top and bottom ribs being altered: the areas of the top and bottom sections as one to four nearly. Strength 3214 lbs. per inch. This result compared with that to be given in experiment 13, for a beam of the common form, shows a gain of one fifth, nearly, in strength.

Experiment 12. Bottom flanch increased. Area of section of top and bottom one to five and a half nearly. Strength 3346 lbs., a gain of nearly one-fourth over the common form as given by experiment 13. If the weight of this beam be considered, it reduces the gain over the common form to one-seventh.

Experiment 13. Beam of the *common form*, cast from the same model as that of experiment 4. Strength 2693 lbs.

The form of the beams experimented upon was now entirely changed.

"The beams in our future experiments were of equal height, through their whole length, and had their top and bottom ribs uniform in thickness, but tapering toward the ends, the bottom rib being parabolic. They are represented by the subjoined vertical plan and elevation, where the sections at the middle of the several beams

are as in the following experiments; and the sections, from their middle toward the ends, as in experiments 11, 9, 3.

Plan.

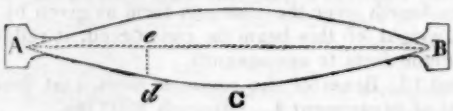
Elevation.

"This form was adopted to save metal, by reducing the bottom rib, which was likely to become very large. The reasonings by which I was led to suggest these deviations from the form of the elliptical beam before used, were the following:

"The vertical part, which was uniform through the whole length,* being thin comparatively with the bottom rib, the beam might be made of equal height throughout, and consequently its depth, and power of bearing near the ends, increased with little additional metal.

"From the form of fracture in the preceding experiments, and the great size which the bottom rib would be of, I was convinced that the neutral line in our future experiments would lie very low,† and, therefore, nearly all the tensile force would be exerted by the bottom rib, whilst the rest of the beam would serve for little more than a fulcrum; the centre of resistance to compression, or of that fulcrum laying very near to the top, it being perhaps at the point r ‡ in our former experiments.

"Suppose D to be the vertical distance from the centre of compression, at any part of the beam, to the centre of tension in the bottom rib; and T to be the direct tensile strength of the bottom rib at that part; then T multiplied by some function of D, (perhaps $T \times D$) will represent the strength of the beam there. But D, throughout the same beam, will be a constant quantity, or nearly so; the strength of the beam, therefore, at any part, will be nearly in proportion to that of its bottom rib at that part; and as the strain will be less toward the ends, the bottom rib may be reduced there likewise.



"Suppose the bottom rib to be formed of two equal parabolas, the vertex of one of them ACB being at C; then by the nature of the

* The vertical part of the beam ought, like the ribs, to have been reduced toward the ends, considering the leverage only; but that was neglected as there might have been too great a tendency in the weight to cut the beam across, near to its ends, if it were more reduced there. See article 33, (page 265.)

† This was verified by the 19th experiment, where the wedge showed the neutral line to be at three-fourths of the depth.

‡ See cuts pages 268, 269, &c.

curve, $d\,e$ is as A $e \times$ B e; the strength of the bottom rib, therefore, and consequently that of the beam at that place will be as this rectangle. It is shown, too, by writers on the strength of materials, that the rectangle A $e \times$ B e is the proportion of strength which a beam ought to have, to bear equally the same weight every where, or a weight laid uniformly over it; it would appear, therefore, that the beam above is rightly devised, and these views will be strengthened by the future experiments.

"The length of the parabola AB in the following experiments, was just four feet six inches, or equal to the distance between the supports, and three inches were added to each end of the beam beyond the points A and B, to lay upon the props; the parabolic bottom was likewise a little strengthened at the ends, as in the figure.

Experiment 14. Distance between the supports $4\frac{1}{2}$ feet, and depth of beam $5\frac{1}{8}$ inches. Strength 3246 lbs. Broken by tension, near the middle of the beam.

Experiment 15. Distance between the supports and depth of beam as before. Area of bottom rib increased from 2.314 inches to 2.916 inches. Strength 3194. Beam broken by tension.

Experiment 16. Beam from the same model, but with a larger bottom rib, viz. of 3.413 inches area. Strength less than preceding, from a defect probably in the material, the beam having broken at but little more than half the deflection at which that of experiment 15 gave way.

Experiment 17. Beam of the common form, as in experiment 4. Result not comparable, the same remarks applying as have been made upon experiment 16. Strength about 2466 lbs. per square inch.

Experiment 18. Beam of the same model as that used in experiment 16. Strength 3317 lbs. per square inch.

"43. The preceding beams were intended to be equally strong, in every part, to sustain a load laid uniformly over them; and to see if that was the case in this beam, I made the following experiment: The larger arm of the beam was placed on two supports, two feet three inches apart, and had 26497 lbs. laid upon its middle, without breaking there: it failed at its fractured end, or it would have been tried further.

"Now, from the principle of the lever, (see problem further on,) the strength of half of a beam so broken, is to the strength of the whole beam, as three to two.

"Hence, as the whole beam broke with 19441 lbs. the half should not have broke with less than 29161 lbs. We have no data to prove whether this would or would not have borne that weight, 26497 lbs. only having been laid on it; it is however probable that it would have borne it or a greater weight.

"Another half of a beam of nearly the same dimensions, and which must either have belonged to that in experiment 15 or 16, broke as before in its middle, with 22255 lbs. the breadth of the bottom rib, at the place of fracture, being 4.6 inches.

Now 2 : 3 : : 16905 (expt. 15) : 25357 lbs.
" 2 : 3 : : 14336 (expt. 16) : 21504 lbs.

"Hence, the strength of the end of the beam was a little in defect or excess, according as it belonged to the former or the latter of these experiments.

"The beams in the preceding four experiments, commencing with experiment 14, were cast together, and supposed to have been from the same iron, but the results were so anomalous that nothing could be learned as to the relative strength; there was, however, one fact proved by them, and that a very important one; every beam had broke by tension, or through the weakness of the bottom rib, which though so large had always been torn asunder, while the top part had remained unchanged. It having been prevented from twisting by the small rib there, showed no signs of being over compressed.

"44. In the following four experiments, and indeed in all the following ones, a good deal of attention was paid to the iron, it was the same as that used in the commencement of this series, and of which a description has been given: it is a strong iron, and was considered by Mr. Lillie as best adapted for beams."

Experiment 19. The last beam having still broken by tension, the bottom rib was again increased, by making it thicker, without altering the depth of the beam. Area of bottom rib 4.4 square inches.

"This beam broke in the middle by compression with 26084 lbs. or 11 tons 13 cwt., a wedge separating from its upper side.

"The weights were laid gradually and slowly on, and the beam had borne within a little of its breaking weight, a considerable time, perhaps half an hour.

"The form of the fracture and wedge is represented by the figure, showing a side view of the beam; where $e\,n\,f$ is the wedge, $e\,f = 5.1$ inches, $t\,n = 3.9$ inches, angle $e\,n\,f$ at vertex $= 82°$.

"It is extremely probable, from this fracture, that the neutral point was at n, the vertex of the wedge, and therefore at three-fourths of the depth of the beam, since 3.9 inches $= \frac{3}{4} \times 5\frac{1}{8}$ inches nearly.

"Hence strength per square inch of section $= \frac{26084}{6.4} = 4075$ lbs.

which is much greater than that in any of our former experiments.

"Comparing this result with that of the common beam in experiment 22nd, which was cast with these, and which bore 2885 lbs. per inch, we have 4075 — 2885 = 1190 lbs. = excess.

"∴ Gain in strength, from the section, $= \frac{1190}{2885} = .41$, or upwards of two-fifths of what was borne by the common beam.

"The quantity of metal saved, through the section, would be re-

presented by the above excess 1190, divided by 4075, the quantity which the beam bore per square inch of section.

"$\therefore$ *Saving of Metal*, from section, $= \frac{1190}{4075} = .292$, or $\frac{3}{10}$ nearly.

"If we compare the strength of this beam, and that in experiment 22, by the weights, as was done in experiments 11 and 12, we shall have the saving in metal, through the section and general form of the beam conjoined, $= .377$.

"As this is the strongest beam we have tried, if it be compared, by weight, with the result from the very strong beam, of the common form, in experiment 7, the saving in metal will be .29.

"45. Thus we have, by constantly making small additions to the bottom rib, arrived at a point where resistance to compression could be no longer sustained; but it was not till the bottom rib had considerably more matter in it than double the rest of the beam, the bottom rib being to the rest as 4.4 to 1.83, and to the top rib as 6 to 1. Still the top rib was not crushed, nor showed any signs of weakness. The fracture took place by the vertical part of the beam becoming torn, by the opposite forces of tension and compression round the neutral line, (see art. 33,*) as was the case in the experiment in article 23.†

"The great strength of this section is an indisputable refutation of that theory, which would make the top and bottom ribs of a cast iron beam equal."

Experiment 20. Same model as that used in experiment 19. The beam broke in the middle by tension with 23249 lbs.

"This is considerably less than what the former beam bore, through its bottom rib, in which the tensile power of this form of section almost wholly lies, was not much different. The iron must therefore have been weaker.

"Strength per square inch of section $= \frac{23249}{6.5} = 3576$ lbs.

"Comparing this with the result of the common beam in experiment 22, which bore 2885 lbs. per inch, $3576 - 2885 = 691 =$ excess.

"$\therefore$ Gain in strength, from section $= \frac{691}{2885} = .236$, in terms of what the common beam bore; whence saving in metal $= \frac{691}{3576} = \frac{1}{5}$ nearly.

"If we compare this beam with the common one, by their weights, the saving metal will be .26, or upwards of $\frac{1}{4}$th.

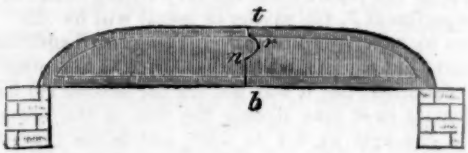
"The thickness of the vertical part of the beam, in experiment 19, was .266, and in this experiment .335; we might therefore have increased the bottom rib of this beam, in the ratio of 335 to 266, or $\frac{1}{3}$d nearly, when it is probable the beam would have broke equally soon by tension, or by the rupture of the vertical part as in experiment 19.

* Page 265. † Page 262.

And a much greater excess of strength than that above would have been obtained."

Experiment 21. The beam *elliptical*, being cast from the same model as that in experiment 12, but having the bottom rib increased: broke near the middle by tension with 21009 lbs.

"Form of fracture nearly as $b\,n\,r$ in figure; $bn = 1.8$ inches.



"Hence strength per square inch of cross section $= \frac{21009}{5.41} = 3883$ pounds.

"Comparing this with the result from the common beam in experiment 22, which bore 2885 lbs. per inch $3883 - 2885 = 998 =$ excess.

"Hence gain in strength $= \frac{998}{2885} = .345$, in terms of what the common beam bore: or saving in metal, from section, $= \frac{998}{3883} = .257$, or upwards of $\frac{1}{4}$th.

"If the comparison be made by their weights, the saving in metal will be only .23, which is less than it would have been, had the ends of the beam been formed as in the preceding ones from experiment 13 to this: the bottom rib of this being all of a breadth and thickness, and five feet long; though the distance of the supports was but four feet six inches. This remark applies, though in a less degree, to the beams in expts. 11 and 12, and those immediately preceding them; those beams, like this, having their vertical part an ellipse, and their bottom rib of equal breadth throughout."

Experiment 22. Beam of the common form for comparison. Accident prevented the results from being of authority. The approximate strength is given at 2885 lbs.

The author next proceeds to comment upon the twenty-two experiments already made.

"46. It has been doubtless remarked that, in most of the foregoing experiments, the vertical part of the beam was made much thinner than the bottom rib; which it was necessary for it to be, otherwise that rib must have been proportionably broader, and this would have endangered the strength of it, by its liability to flexure. The injury from irregular cooling in metal of unequal thickness, I was in some degree acquainted with, and it was soon mentioned to me by Mr.

Ewart, whose extensive general knowledge and kindness left few maxims connected with the material uncommunicated. It was felt to be an objection: the appearance of the surface of fracture was minutely examined, but nothing was elicited from it: there was a difference in the aspect of the bottom rib and other parts, but only such as iron of different thickness unconnected would have shown. There was a powerful argument, too, in our favour; we had excellent castings; they had no flaws or defects in them which could be attributed to the cause mentioned above, and their progressively increasing strength left it, I conceive, without doubt, that irregular cooling had no mischievous effect on beams cast like ours. The reason of it may possibly be this, the beam being mostly cast erect, and wrong side up, the heavy bottom rib, lying near the surface in the sand, might nearly keep pace in cooling with the thinner part lower down; and in those cases where the beam was cast on its side, it would cool more regularly with the sand in which it was buried.

"47. In the preceding experiments, it has been mentioned, that we began with that form of section which a highly ingenious modern writer on the strength of cast iron was induced to consider as the strongest to preserve its elasticity, the top and bottom ribs in it being equal; and this form we found to be $\frac{1}{12}$th weaker to resist an ultimate strain, than that of the common beam in the iron on which he wrote, though it would, as we have before seen, be perhaps the strongest in wrought iron. We then, by gradually reducing the top rib in the same model, and adding the part taken off to the bottom one, obtained castings in which the strength was found to be regularly increasing, and the form, in experiment 3d, somewhat stronger than that of the common beam. It did not now seem adviseable to decrease further the top rib; and as every beam had been found to break by tension, or through the weakness of the bottom part, I thought it best to keep increasing the bottom rib by small degrees until the beam broke by the rupture of some other part. This increase was commenced in experiment 9, the ribs in that being as $4\frac{1}{2}$ to 1; and the result, from the form of section, in this case was a gain in strength of about $\frac{1}{7}$th: this beam also broke by tension. Now before increasing the bottom rib any further, I thought it adviseable to add a little to the top one, as the vertical part of the beam, or that part between the ribs would be, perhaps, strong enough for much larger ribs. In expts. 11, 12, and 21, the top rib and vertical part of the model were the same, the only difference being in the breadth of the bottom rib: from the first of these the increase of strength in terms of what was borne by the common beam was $\frac{1}{5}$th, from the second $\frac{1}{4}$th, and from the third $\frac{1}{3}$d; and had we added still more to the bottom rib in the same model, it is probable that the gain might have been much greater.

"48. In experiments 14, 15, 16, 18, 19, and 20, the top rib of the model was the same, but somewhat larger than in experiments 11, 12, and 21, and the bottom rib was the only one varying. In the 19th experiment the section of the bottom rib at the place of fracture was more than double the rest of the section, and the ratio of

top and bottom ribs was 1 to 6. In this instance the fracture took place by the rupture of the vertical part of the beam, which happened to be thinner than usual; the gain in strength here, from the section, was upwards of $\frac{2}{5}$ of what the common beam bore; and the saving by it was nearly $\frac{3}{10}$ of the metal. This experiment was repeated in expt. 20, but the beam seems to have been of somewhat weaker iron.

"49. The form of section, in experiment 19, is the best which we have arrived at for the beam to bear an ultimate strain. That in experiment 21, if its bottom rib had been a little further increased, would, it is probable, have borne nearly as much per square inch of section, but its narrower top rib, when tapering towards the ends as in our latter beams, might probably have allowed the beams to have twisted there; a tendency which was observed in an experiment further on. If, then, we adopt the form of beam in experiment 19, I think we may confidently expect to obtain the same strength with a saving of upwards of $\frac{1}{4}$th of the metal; or in other words, that 75 tons of metal will bear more than 100 tons would, if cast in the best models of the usual form.

"50. In the first seven of the preceding experiments those deflections which were obtained were taken in the middle of the beam, but from the mode then used, not with great accuracy. In the succeeding ones a good deal of care was taken, and I imagine they are not very incorrect, though, on account of the smallness of the deflections, inaccuracies could scarcely be avoided; they were not in these taken in the middle of the beam, but three inches from it, as it was more convenient to take them there than in the middle.

"51. If we examine the deflections in experiments 18, 20, and 21, we shall find that in the first and third about two-thirds, and in the second upwards of one-half the breaking weight was laid on without the elasticity being in appearance at all injured. Now this is contrary to former experience, it having been generally found that the elastic force was sensibly injured with about one-third of the breaking weight, (Tredgold's Essay, p. 79.) And as experiments have mostly been made upon rectangular pieces, the above fact, if properly ascertained, will render it probable that change of form may have an influence upon this ratio; and may, in some forms, remove the point of incipient derangement from one-third to one-half, or even two-thirds of the breaking weight.

"52. In the preceding experiments the beams being short, and the deflections small, there was considerable difficulty in ascertaining the precise point where the above defect took place; but the matter seemed to be too important to be allowed to pass without some further investigation, and especially as we should be enabled at the same time to determine what influence a change in the depth of one of our beams would have upon its strength, every other dimension remaining the same. For these purposes, therefore, I made the following experiments.

"In these, and indeed in all the future experiments, the same sort

of beam was used as that in our last, and which was described immediately before experiment 14; it was broken too in the same manner. There was, however, this slight difference, that there the parabolic base was but just equal in length to the distance between the supports, and the beam had its ends rendered a little wider and longer with matter attached to them to lie on the props; but here the parabola was made six inches longer than the distance between the props, in order that three inches of it might lie upon them at each end; this was done to render the beam capable of bearing more towards the ends, as there was some doubt whether in the preceding experiments the ends were not a little too weak. The beams were all cast seven feet six inches long, and were supported by props seven feet asunder; they were from the same model, which varied only in the breadth of its vertical part, the depth of the beam being all that was intended to vary. The depths were nearly four, five, six, and seven inches; but accurate admeasurements are given with the sections.

"The vertical part in the beams was rendered too strong comparatively with the size of the bottom rib; it was desirable it should be so, that they might all break by tension, or in the same manner, to furnish the means of judging correctly of their relative strength. The bottom rib ought otherwise to have been made stronger, or the vertical part thinner."

Experiment 23d being the first of a new series, we extract the details.

XXIII. EXPERIMENT.

"Distance between supports seven feet, depth of beam 4.1 inches.

Dimensions of section at place of fracture, or middle.

Area of top rib = 2.25 × .33 = .74 in.
,, bottom ,, = 6.00 × .74 = 4.44 ,,
Thickness of vertical part = .40 inches.
Area of section = 6.54 inches.

Weight of casting = 1 cwt. 0 qrs. 2 lbs. = 114 lbs.

Weight in lbs.	Deflections in parts of an inch.	Returned to (weights removed.)
2764	.25	0
2879	.25	0
2994	.26	0
3109	.26	0
3224	.27	0 doubtful.
3339	.28	0
3454		perceptible set.
3569	.29	"
3684	.31	.04
3914	.32	.05
4029	.32	.05

"The beam was now removed, and having been again placed under the lever, the experiments were recommenced, and the deflections taken from the form it had assumed.

Weights.	Deflections.	Returned to.
5180	.40	0
5353	.41	0
5525	.44	0
5698	.44	0
6042	.45	0
6215	.51	0
6971	.55	apparent set.
7349	.57	
7727	.62	
8105	.64	
8483	.70	
8861	.74	

"The beam not having been broke at this time, the experiment was resumed two days afterwards, when the beam seemed nearly straight again, and the deflections were those from the form it then had acquired.

Weights.	Deflections.	Returned to.
8637	.75	.03
9327	.76	.03
10017	.80	.03
10707	.88	.03
11397	.95	.04
12087	1.04	.08
12815	1.08	.09

13543 It broke with this within $1\frac{1}{2}$ inches of the middle by tension: 13543 lbs. = 6 tons, 103 lbs.

"53. For a beam to support equally through its whole length a uniform load, it is necessary that it should bear the same weight, when applied towards its ends, that it bore in the middle. To ascertain whether the above beam would have done this, the longer half of it was placed upon two supports three feet six inches asunder; one prop supporting the end as before, and the other lying under the middle of the beam. Weights were then gradually laid on, half way between the supports, till fracture took place. It broke with 23396 lbs. or 10 tons $8\frac{3}{4}$ cwt., 15 inches from the end, and where the breadth of the bottom rib was 3.85 inches. Now, by the property of the lever, the pressure, which the whole beam bore, is, to the weight which the half beam broken as above, should have borne, as two to three. Hence 2 : 3 : : 13543 lbs.: (weight borne by whole beam:) 20314 lbs. = weight which the half beam should have borne: but it required 23396 lbs. to break it; hence a parabolic beam similar to that above, seven feet six inches long, and broken by props seven feet asunder, is rather too strong toward the ends; and it would have been too strong there still, if the props had been seven feet six inches distant, or at the ends of the parabolic base of the beam.

"54. The other half of the beam was turned the wrong way up, and broken by weights gradually laid on its middle, or half way between the props, one prop supporting the end of the beam as before, and the other placed three feet three inches from it. It broke in the middle with 13356 lbs. or 5 tons 19¼ cwt.

"If we reduce this weight to what it would have been if the distance of the props had been three feet six inches as above, we have three feet six inches: 3 feet 3 inches, or 14 : 13 : : 13356 :12402 lbs. or 5 tons, 10¾ cwt. which is little more than one-half of what the former half beam bore; and the difference of strength would have been much greater, if we had used two equal whole beams. Hence we see the impropriety of turning beams the wrong side up, as is often done in factories. But this matter was still more clearly shown in one of our early experiments (art. 23,) where a T section of cast iron bore nearly four times as much one way up as the other."

Experiment 24. Distance between the supports seven feet, depth of the beam 5.2 inches. Area of top rib .79 sq. inch, of the bottom rib 4.62 sq. inches. Weight of casting 128 lbs. Broke by tension near the middle, with a weight of 15129 lbs. Strength per square inch 2180 lbs. The relative strength of this beam supposing it four feet six inches long, would have been 3391 lbs. per square inch, the material was therefore weaker than that forming the beams of experiments 19, 20 and 21.

Experiment 25. Distance between the supports as before. Depth of beam six inches. Areas of top and bottom rib very nearly as in experiment 23. Weight of casting 127½ lbs. Broke by tension near the middle with 15129 lbs. The author supposes this beam to have been rendered weak by a twist in the vertical part of the casting. The elasticity was nearly destroyed by a weight of 12087 lbs.

Experiment 26. Depth of beam 6.93 inches. Areas of top and bottom ribs nearly as before. Weight of casting 146 lbs. Elasticity nearly destroyed by 13543 lbs. Beam broken by tension exactly in the middle, by a weight of 22185 lbs.

Experiment 27. Depth of beam 6.98 inches. From the same model as the last. Weight of beam 141 lbs. A weight of 19049 lbs. produced a deflection of .58 of an inch.

"With this last weight the beam was conceived to be very near fracture; the weights were therefore removed, and the casting was found to have taken a set of one-tenth of an inch.

"56. To ascertain whether the beam was as strong towards the ends as in the middle to bear a uniform load, weights were now gradually laid upon the beam, at a point half way between the middle and the end, in the same manner as in the note after experiment 24. It bore 20225 lbs. for about half a minute, and then broke near the end, at a place in the under side of the bottom rib, where it was rather unsound. The inference from this experiment, though imperfect, is that the beam would bear a somewhat greater weight near the ends than in the middle.

"57. From these experiments it appears that the ultimate strength in sections like the preceding, is, cæteris paribus, nearly as the depth; but somewhat lower than in that ratio.

"With regard to the elasticity there are some anomalies; experiments 25 and 26 exhibited no defect, when the first beam had borne upwards of two-thirds, and the latter more than one-half the breaking weight. But experiment 23, which was on a beam of very small depth, shows a deviation at an early period, it was, however, very small till upwards of half the breaking weight was laid on; when perhaps the elasticity of the bottom rib began to be injured. The former defect being attributable to some inconsiderable falling off in the elasticity of the compressed part of the beam; possibly arising from oblique compression, through greater flexure in a shallow beam.

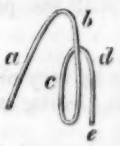
"58. There seems, therefore, to be little doubt that the elastic force is longer perfect in these forms than in those on which experiments have generally been made, and the reason may probably be this: the earlier deflections in our best beams are almost wholly caused by compression, on account of the smallness of the compressed part; and it appears highly probable that cast iron would remain perfectly elastic under much greater forces when applied directly to compress it, than would be required to injure its elasticity by tension."

[TO BE CONTINUED.]

TRANSLATIONS FROM THE FRENCH JOURNALS.*

Chemical Instruments.

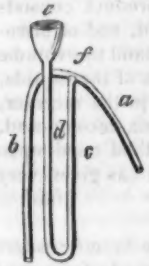
At the session of the Society for the Encouragement of National Industry, November 29th, M. Collardeau presented two syphons of a new and ingenious construction. They are applicable to cases in which liquids of a corrosive nature, or at a high temperature, are to be transferred from one vessel to another. The first is a common glass syphon of which one of the branches is bent twice so as to return upon itself; (See annexed cut.) One extremity



e terminates in a capillary tube. The syphon is made to fill itself by placing the finger upon the opening *e* and plunging the branch *a*, up to the curved part, in the liquid. The finger removed, the liquid passes the curved part of the branch *a*, descends through *b*, and rising again flows into the branch *d*, issuing through the opening *e*. When the transfer of the liquid is completed, and the syphon removed, two columns of liquid of equal height remain in the branches *b* and *c*, and to set the syphon again in operation it is only necessary to plunge the branch *a* in the liquid. It is unnecessary to enter into the explanation of the mechanical laws which produce the action just described. We pass rather to a description of the second

* Made at the request of the Committee on Publications.

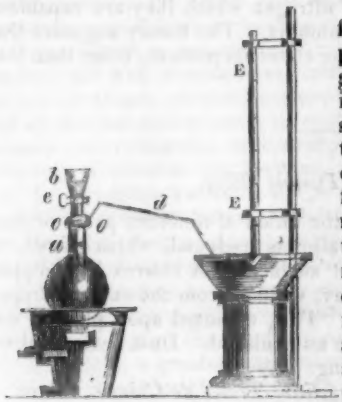
syphon which will be more generally useful in the arts than the one just described. This is a common syphon, of which the two branches *a* and *b* are shown in the annexed cut. To this syphon is joined a tube bent into the form of the letter U. One of the branches, *d*, rises higher than the bend of the syphon, and is terminated by a receptacle, *e;* the other branch, *c*, joins the syphon at *f*. To put this syphon in action, a small quantity of the liquid to be transferred is put into the receptacle *e*. This liquid fills the tube *d*, rises into *c*, and passes into the branch *a;* the branch *b* being dipped into the liquid to be decanted it rises in *b*. By pouring more liquid into *e*, causing a flow through *a*, the liquid is drawn into the bend joining *b* and *a*, and the syphon is filled.



[*Bulletin de la Société d'Encouragement, &c.*

New method of testing the Strength of Bleaching Powders.

The important object of a test for the strength of bleaching powders has given rise to many ingenious methods, of more or less easy execution. The following is proposed by MM. Henry, Jr. and A. Plisson. It is founded upon the property which chlorine has, whether free or combined with oxides, of reacting, by the aid of heat, upon certain salts of ammonia, or upon a solution of ammonia in water. The product of this reaction will be nitrogen gas in a proportion to the chlorine which may be calculated by theory.



The apparatus consists of a glass flask of the capacity of about half a pint. Into the neck of the flask a glass funnel *b* is cemented, having a stop cock *e*, and through a second opening in the neck a bent tube *o d* is passed. This serves to conduct the gas disengaged in the flask into a tube E E where the measurement is made. To apply the apparatus, the solution of chlorine, or of the chloride, in a known quantity of water, is placed in the flask, which is then tightly corked and the tube *o d* inserted. Next a solution of some ammoniacal salt, as the sulphate, the carbonate, or bi-phosphate of ammonia is added: this last mentioned salt, or a solution of ammonia, is to be preferred to the other compounds mentioned. Heat is gradually applied, and the gas carefully collected over water which should be ren-

dered slightly alkaline when carbonic acid may be one of the products of the reaction. When the operation is concluded, the flask is filled with water to drive out all the gas. The gaseous product consists of the atmospheric air which the apparatus contained, and of nitrogen from the decomposed ammonia. Knowing beforehand the volume of air which the flask contained after the introduction of the liquids, and subtracting it from the bulk of the gas collected in the receiver, the quantity of nitrogen corresponding to the ammonia decomposed, that is to the chlorine present, is found. This method tried upon liquids of which the composition was exactly known has given very satisfactory results. [*Ibid.*

Note by Translator.—It may not be amiss to state to our readers the theory of the above process. Ammonia is composed of nitrogen and hydrogen, in the ratio of three parts by bulk of hydrogen to one part by bulk of nitrogen. Chlorine unites with hydrogen to form muriatic acid; the chlorine in muriatic acid being to the hydrogen in the ratio of one part by bulk of chlorine, to one part by bulk of hydrogen. If a solution of chlorine react upon a solution of ammonia, for every three parts by bulk of chlorine which unite with hydrogen, one part by bulk of nitrogen gas is liberated. Every part, say cubic inch, of nitrogen which is collected in the process just described, corresponds to three parts, cubic inches, of chlorine in the solution of chlorine or of the chloride: deduction having been made for the atmospheric air introduced from the flask. If we would know the proportion of chlorine by weight in a given weight of the chloride, it is readily found from the ascertained bulk. One hundred cubic inches of chlorine gas when the thermometer is at 60° Fah. and barometer at 30 inches, weigh 76.25 grains. The relative values of different bleaching powders will be given by the relative bulks of nitrogen which they are capable of disengaging from a solution of ammonia. The theory supposes that no reaction takes place between the elements present, other than that just described.

Mirrors of Fusible Alloy.

Berzelius has found that by the union of nineteen parts of lead and twenty-nine of tin, a fusible alloy is produced, which affords, on cooling in thin plates, very bright surfaces. A convex lens dipped several times into the melted alloy, yielded from the surface dipped a concave mirror of great lustre. This, mounted upon plaster, was preserved for some time in the air untarnished. Dust destroys these mirrors, which will not bear wiping.

[*Ibid, or Berzelius, Traité de Chimie, vol. iii.*

¶ *On the Employment of Heated Air in the Smelting of Iron.**

Among the many discoveries that have of late been made in chemical science, there are perhaps few of more practical importance than the ingenious application of heated air in the smelting of iron ore, either in the immediate benefit which it will confer on this important art, or in the various improvements which it is likely to lead to in other operations. The following is a very brief outline of the manner in which the heated air is applied in some of the iron works where this method of working the ore has been introduced.

The air is blown by cylinder bellows in the usual manner, but before entering the smelting furnace it passes through pipes of cast iron heated to redness, which are altogether about thirty feet in length, and three feet in diameter. They are usually made in three or four pieces, joined together by apertures considerably less than three feet in diameter, and placed horizontally, or in whatever manner the local arrangements about the furnace may render most convenient. A brick arch is then thrown round the pipes, leaving a free space of about eight inches and upwards between it and them, and two or more furnaces constructed so as to heat the pipes in the archway, the flues playing into it, and terminating in a common vent at the farther extremity. They may be considered, therefore, as placed on the floor of a long and reverberatory furnace, about six feet high, and nearly of the same breadth, being at the same time protected by fire bricks where they might be injured by the direct flame of the furnaces.

The iron ore is smelted according to this plan with little more than half the coal necessary when the furnaces are worked with air in the usual manner; the small coal which is sold at an inferior price is found quite sufficient for heating the pipes.

It has also been ascertained, that there is no difficulty in smelting the iron ore with common coal instead of coke, and in some furnaces at present in use, no coke whatever is employed, so that it is probable the trouble and expense attending its preparation will be unnecessary. It is likewise in contemplation to endeavour to reduce the iron ore at once in the furnace, without any previous calcination, and the proprietors of some of the iron works seem to entertain little doubt that they will be successful in the attempt.

The great effect produced by the heated air in these furnaces must be attributed to the circumstance that, according to this plan, a higher temperature can be more easily excited and maintained, than when the blast is supplied with air at the ordinary temperature of the atmosphere. And the great saving of fuel we would presume, does not arise from a greater *quantity* of heat being evolved from a given quantity of coke, or coal, in the one case than in the other, but from the greater *intensity* of temperature that prevails when the heated air is

* Articles selected by the Committee of Publication will in future be designated by this mark, ¶.

employed, insuring the more steady and certain action of the charcoal on the calcined iron-stone, less or none being exhausted without any adequate return, i. e. consumed at an inferior temperature, without affecting the ore in contact with it. It is possible, however, that the absolute quantity of heat evolved may differ according to the temperature at which an inflammable substance is consumed, though no precise experiments have been made to determine this.

If we consider the quantity of air required for the combustion of common inflammable matter, we shall be better able to appreciate the important effects which must arise from the use of heated air. Let us suppose that coke alone is used in the smelting furnace, and that carbonic oxide is the sole product of the combustion in that part of the furnace where the blast takes effect upon the fuel, then, even according to this calculation, every six parts by weight of charcoal require no less than thirty-six of atmospheric air for their combustion, this quantity containing only eight parts of oxygen. Accordingly, though the air may be so thin and attenuated that we are apt to overlook its cooling influence, every portion of combustible matter mixes with six times its weight of cold air, (air at natural temperatures,) all of which must be heated to a certain extent at the expense of the fuel already in a state of combustion, before it can give out any heat by its action on the inflammable matter of the coal. If, again, carbonic acid be the product of the combustion when the heat is more powerful, twice as much air, (seventy-two parts,) will be necessary for every six of charcoal, or each portion will require twelve times its weight of air. The first effect of the introduction of this large quantity of cold air, must be to diminish the actual temperature of the furnace, however much it may add to it immediately afterwards as it is consumed. If, then, the air be heated before it passes to the furnace, its temperature must be higher than when air is supplied in the usual manner, just in proportion to the degree of heat previously communicated to it.

The high temperature of the furnace not only enables the iron ore to be melted with less fuel than would otherwise be necessary, but by effecting a complete separation of the scoriæ from the melted iron, may contribute also to produce a purer and more perfect pig iron; as it is possible, however, that under these circumstances the iron may receive a larger impregnation of the bases of the earths which are decomposed in small quantity during this operation, the quality of the product demands the most careful examination. The specimens we happened to see, so far as we could judge from bare inspection, appeared excellent.

[*Edinburgh New Philos. Jour. for January*, 1832.

Steam Carriages.

The Committee of the House of Commons, appointed to examine the practicability of employing steam carriages on ordinary roads,

having issued their report, we have much pleasure in presenting our readers with an extract of such parts as appear to possess a character of importance, and to throw light upon this interesting subject.

"The committee proceeded in the first instance to inquire how far the science of propelling carriages on common roads, by means of steam or mechanical power, had been carried into practical operation; and whether the result of the experiments already made had been sufficiently favourable to justify their recommending to the house, that protection should be extended to this mode of conveyance, should the tolls imposed on Steam carriages, by local acts of parliament, be found prohibitory or excessive.

"In the progress of their inquiry, they have extended their examination to the following points on which the chief objections to this application of steam have been founded; viz. the insecurity of carriages so propelled, from the chance of explosion of the boiler, and the annoyance caused to travellers, on public roads, by the peculiar noise of the machinery, and by the escape of smoke and waste steam, which were supposed to be inseparable accompaniments.

"It being also in charge to the committee, 'to report upon the proportion of tolls which should be imposed upon steam carriages,' they have examined several proprietors of those already in use, as to the effect produced on the surface of roads by the action of the propelling wheels.

"As this was too important a branch of their inquiry to rest entirely on the evidence of individuals whose personal interest might have biassed their opinions, the committee also examined several very scientific engineers, by whose observations on the causes of the ordinary wear of roads they have been greatly assisted.

"The committee were directed also to report 'on the probable utility which the public might derive from the use of steam carriages.' On this point they have examined a member of the committee, well known for his intelligence and research on subjects connected with the interests of society, and they feel that they cannot fulfil this part of their instructions better than by merely referring the house to the evidence of Colonel Torrens.*

"These inquiries have led the committee to believe that the substitution of inanimate for animal power, in draught on common roads,

* He says, "I conceive that agriculture is prosperous in proportion as the quantity of produce brought to market exceeds the quantity expended in bringing it there. If steam carriages be employed instead of carriages drawn by horses, it will be because that mode of conveyance is found the cheapest. Cheapening the carriage of the produce of the soil must necessarily diminish the quantity of produce expended in bringing a given quantity to market, and will therefore increase the net surplus, which net surplus constitutes the encouragement to agriculture. For example, if it requires the expenditure of two hundred quarters of corn to raise four hundred, and the expenditure of one hundred more on carriage, to bring the four hundred to market, then the net surplus will be one hundred.

"If, by the substitution of steam carriages, you can bring the same quantity to market, with an expenditure of fifty quarters, then your net surplus is increased from one hundred to one hundred and fifty quarters: and consequently

is one of the most important improvements in the means of internal communication ever introduced. Its practicability they consider to have been fully established; its general adoption will take place more or less rapidly, in proportion as the attention of scientific men shall be drawn by public encouragement to further improvement.

either the farmer's profit, or the landlord's rent increased in a corresponding proportion. There are many tracts of land which cannot be cultivated, because the quantity of produce expended in cultivation and in carriage exceeds the quantity which that expenditure would bring to market. But if you diminish the quantity expended in bringing a given quantity to market, then you may obtain a net surplus produced from such inferior soils, and consequently allow cultivation to be extended over tracts which could not otherwise be tilled.

"On the same principle, lowering the expense of carriage, would enable you to apply additional quantities of labour and capital to all the soils already under cultivation. But it is not necessary to go into any illustrative examples to explain this, it being a well known principle, that every improvement which allows us to cultivate land of a quality which could not previously be cultivated, also enables us to cultivate, in a higher manner, lands already under tillage.

"If steam carriages were very suddenly brought into use, and horses thereby displaced, I think the effect stated in the question would be produced for a time; but practically, steam carriages can be introduced only very gradually, and the beneficial effect upon the profits of trade, by bringing agricultural produce more cheaply to market, will tend to increase profits, to encourage industry, and to enlarge the demand for labour; so that, by this gradual process, there will probably be no period during which any land can actually be thrown out of cultivation, the increasing population requiring all the food which horses would cease to consume.

"With respect to the demand for labour, that demand consists of the quantity of food and raw materials which can be cheaply obtained: and as, by the supposition, the displacing of horses will leave at liberty more food and more material, the demand for labour will ultimately be greatly increased instead of being diminished. It has been supposed, I know not how accurately, that there are employed on the common roads in Great Britain, one million of horses, and a horse, it is calculated, consumes the food of eight men. If steam carriages could ultimately be brought to such perfection as entirely to supersede draught horses on the common roads, there would be food and demand for eight millions of persons. But when we take further into consideration, that lowering the expense of carriage would enable us to extend cultivation over soils which cannot now be profitably tilled, and would have the further effect of enabling us to apply, with a profit, additional portions of labour and capital to the soil already under tillage, I think it not unfair to conclude, that were elementary power on the common roads completely to supersede draught horses, the population, wealth, and power of Great Britain, would at least be doubled.

"If there are soils of such a peculiar quality that oats is the only marketable product which they will yield, the persons employed in cultivating those lands would certainly be thrown out of that particular occupation; but the extension of tillage over other lands, not of this peculiar quality, would create a demand for labour, which would much more than absorb the persons thrown out from the culture of oats upon that land which would grow nothing else. But I doubt of there being any land which it is profitable to cultivate, which would not raise some other agricultural produce than oats, either for man or cattle, for which the increasing population would create a demand.

"Upon the case supposed, namely, that steam carriages should be employed in conveying passengers only, and the whole change to be effected in a sudden manner, I think that there would, in the first instance, be a diminished demand for agricultural produce, but the following process would take place. As the demand for agricultural produce was diminished, the price of such produce

"Tolls, to an amount which would utterly prohibit the introduction of steam carriages, have been imposed on some roads; on others, the trustees have adopted modes of apportioning the charge, which would be found, if not absolutely prohibitory, at least to place such carriages in a very unfair position as compared with ordinary coaches.

"Two causes may be assigned for the imposition of such excessive

would fall, food would become cheaper, and the cheapening of food would benefit partly the labouring class, and partly the capitalists, the one obtaining higher real wages, and the other higher profits; this increase in real wages, and in profits, would effect a great encouragement to manufacturing industry, and would necessarily lead to an increase in the manufacturing population, and to the amount of capital employed in manufactures. The consequence would be, that after some degree of pressure upon agriculture, the increased number of human beings would create the same demand for agricultural produce which the employment of horses formerly created.

"So that even upon the extreme and most improbable supposition, that steam carriages should never be employed in conveying agricultural produce to market at a cheaper rate, still the benefit to the country would be very great, inasmuch as we should have a vastly increased industrious population, and England would become, much more extensively than she is at present, the great workshop of the world. In point of fact, superseding horses by mechanical power, would have precisely the same effect in increasing the population and wealth of England, as would be produced were we to increase the extent of the country by adding thereto a new and fertile territory, equal in extent to all the land which now breeds and feeds all the horses employed upon common roads. Such addition to the extent of fertile territory in England, suddenly effected, would, in the first instance, lower the value of agricultural produce, and be injurious to the proprietors of the old portion of the territory, but no person would therefore contend that if we could enlarge the island of Great Britain by additional tracts of fertile land, the public interests would be injured by such enlargement; this would be monstrously absurd. It is not less absurd to object to the increase of food available for human beings, by substituting mechanical power for horses.

"On the principles that have been already stated with respect to agriculture, the cost of bringing all things to market is comprised of the cost of production and the cost of carriage. Reducing the cost of carriage is precisely the same thing in its effects as reducing the immediate costs of production, consequently the conveyance of light goods by steam power, must cheapen all such goods to the consumers. This will necessarily enable them to consume a greater quantity of such goods, and the consumption of the greater quantity will enlarge the demand for labour, call a larger manufacturing population into existence, and thereby re-act on agriculture by increasing the demand for food.

"This cheaper mode of internal carriage will not only lower the price of light and refined manufactures to the home consumer, but will lower their price also to the foreign consumer. This will increase the advantages which we at present possess in the foreign market, and tend to increase our foreign commerce. So that here again there will be an increased demand for manufactures and for a manufacturing population, and here again will be another beneficial re-action upon the soil. So that the more we contemplate the various effects produced upon the industry of the country by a cheaper mode of conveyance, the more we must be convinced that wealth and population will be increased, and that agriculture, instead of being injured, must necessarily partake in the increased prosperity of the country. In addition to what I have already stated, the saving of expense and of time in conveying passengers and goods, and the rapidity of communication, will produce effects, the amount of which it would be almost impossible to calculate."

tolls upon steam carriages. The first, a determination on the part of the trustees, to obstruct, as much as possible, the use of steam as a propelling power; the second, and probably the more frequent, has been a misapprehension of their weight and effect on roads. Either cause appears to the committee a sufficient justification for their recommending to the house that legislative protection should be extended to steam carriages with the least possible delay.

"It appears from the evidence, that the first extensive trial of steam, as an agent in draught on common roads, was that by Mr. Gurney, in 1829, who travelled from London to Bath, and back, in his steam carriage. He states, that although a part of the machinery which brings both the propelling wheels into action, when the full power of the engine is required, was broken at the onset, yet that on his return he performed the last eighty-four miles, from Melksham to Cranford Bridge, in ten hours, including stoppages. Mr. Gurney has given to the committee very full details of the form and power of his engine, which will be found in the evidence.

"When we consider that these trials have been made under the most unfavourable circumstances—at great expense—in total uncertainty—without any of those guides which experience has given to other branches of engineering; that those engaged in making them are persons looking solely to their own interest, and not theorists attempting the perfection of ingenious models; when we find them convinced, after long experience, that they are introducing such a mode of conveyance as shall tempt the public, by its superior advantages, from the use of the admirable lines of coaches which have been generally established; it surely cannot be contended, that the introduction of steam carriages on common roads is, as yet, an uncertain experiment, unworthy of legislative attention.

"The several witnesses have estimated the probable saving of expense to the public, from the substitution of steam power for that of horses, at from one-half to two-thirds.

"Perhaps one of the principal advantages resulting from the use of steam, will be, that it may be employed as cheaply at a quick as at a slow rate; 'this is one of the advantages over horse labour which becomes more and more expensive as the speed is increased. There is every reason to expect that in the end the rate of travelling by steam will be much quicker than the utmost speed of travelling by horses; in short, the safety to travellers will become the limit of speed.' In horse draught the opposite result takes place; 'in all cases horses lose power of draught in a much greater proportion than they gain speed, and hence the work they do becomes more expensive as they go quicker.' On this, and other points referred to in the report, the committee have great pleasure in drawing the attention of the house to the valuable evidence of Mr. Davies Gilbert.*

* Mr. Gilbert says:—"I have made some further remarks, which I would beg to deliver in also, tending to point out particularly the advantage of steam conveyance when the rate of travelling is great: I would beg to add, that it appears to me extremely difficult to lay down any general rule which would be

"Without increase of cost then, we shall obtain a power which will insure a rapidity of internal communication far beyond the utmost speed of horses in draught; and although the performance of these carriages may not have hitherto attained this point, when once it has been established that at equal speed we can use steam more cheaply in draught than horses, we may fairly anticipate that every day's increased experience in the management of the engines will induce greater skill, greater confidence, and greater speed.

"Nor are the advantages of steam power confined to the greater velocity attained, or to its greater cheapness than horse draught. In the latter, danger is increased in as large a proportion as expense,

applicable to all situations and all roads, inasmuch as they vary with the nature of the materials: that up to a certain weight, proportionate to the corresponding width of the wheel, it is probable that the injury to any road may be very little, but that beyond a certain weight, compared again with a corresponding breadth of the wheels, the materials would be entirely crushed and the road totally destroyed; therefore it follows, that even on all roads there must be a limit to the weight of carriages, as it is quite impossible that a wheel of enormous breadth could bear uniformly on all its surface. For instance, where trains of artillery are drawn over roads, the excess of their weight, beyond what the materials are capable of sustaining, has been found sufficient for grinding them to powder. The slow conveyance of heavy weights may perhaps be affected by steam on well made and nearly level roads, so as to supersede the use of horses; but steam power is eminently useful for producing great velocities. It was last year determined by the Society of Civil Engineers, after much inquiry and discussion, that the expense of conveying carriages drawn by horses was at its minimum when the rate equalled about three miles an hour, and that expense of travelling increased up to the practical limit of speed, nearly as the velocity; including the greater price of horses adapted to swift driving, their increased feed and attendance, the reduced length of their stages, and with every precaution, the short period of their services; on the contrary, friction being a given quantity as well as the force requisite for impelling a given weight up a given ascent, the power required for moving steam carriages on a rail-way remains theoretically independent of its speed, and practically increases but a very little, in consequence of resistances from the atmosphere, slight impacts against the wheels, inertia of the reciprocating piston, &c. The expenditure of what I have termed efficiency, is as the actual force multiplied by the velocity, and the consumption of fuel in a given time will be in the same proportion, but the time of performing a given distance being inversely as the velocity, the expenditure of fuel will theoretically be constant for a given distance, and very nearly so in practice. The power requisite for moving bodies through water is the opposite extreme; here, the mechanical resistance of the fluid increases with the square of the velocity, as do the elevation of the water at the prow and its depression at the stern. The oars, or paddles, must therefore preserve a constant ratio to the velocity of the vessel; and the force applied will consequently vary as the squares of the velocity; and the expenditure of efficiency being as the force multiplied by the velocity, the consumption of fuel will be as the cube of the velocity in a given time, or as the square of the velocity on a given space; and I have ascertained from the records of voyages performed by steam vessels, that the law is nearly correct in practice: hence the great power required for such steam vessels as are constructed not merely for speed, but also to set at defiance the opposition of winds and seas; while, on the contrary, a very small power will be found sufficient for moving ships of the largest dimensions through the water, at the rate of two or three miles an hour, when their sails are rendered useless by continued calms.

by greater speed. In steam power, on the contrary, 'there is no danger of being run away with, and that of being overturned is greatly diminished. It is difficult to control four such horses as can draw a heavy carriage ten miles per hour, in case they are frightened, or choose to run away; and for quick travelling they must be kept in that state of courage, that they are always inclined for running away, particularly down hills, and at sharp turns of the road. In steam, however, there is little corresponding danger, being perfectly controllable, and capable of exerting its power in reverse in going down hills.' Every witness examined has given the fullest and most satisfactory evidence of the perfect control which the conductor has over the movement of the carriage. With the slightest exertion it can be stopped or turned, under circumstances where horses would be totally unmanageable. [*Lond. Jour.*

Remarks on the Explosion of Steam Boilers. Submitted by Mr. Jacob Perkins, *Civil Engineer, to the Select Committee of the House of Commons on Steam Navigation.**

A vast number of contrivances have been resorted to, to remove the great evil of steam boilers exploding. When the safety valve was invented, it was supposed that this desideratum was accomplished, as nothing theoretically appeared more certain. It was believed that all that then remained wanting was a boiler stronger than the power required to work the steam engine, after which all would be safe, if the safety valve should be kept in order. Time and practice have disappointed these sanguine hopes. That the safety valve cannot be depended on, as a security against explosions, is but too true; in fact, strange as it may appear, the safety valve often hastens the explosion. It has been ascertained beyond all doubt, that explosions frequently follow immediately upon the opening of the safety valve. The cause of this paradox would still have been among the secrets of science, had not a recent discovery pointed out its source, and, I trust, that I shall be excused availing myself of the coinciding testimony of the celebrated Mons. Arago on this part of the subject.

In his publication on the explosion of steam boilers, he thus expresses himself: "How does it happen that a boiler bursts at the very moment of the opening of the safety valve? How does it happen that the accident is almost always preceded by an apparent diminution in the elasticity of the steam? These questions, involving seeming paradoxes, are suggested by the accidents recorded in this paper. Mr. Perkins has, I think, answered them satisfactorily; and I shall lay before the reader the explanation given by that engineer."

I now proceed with the explanation therein adverted to.

In one of my experiments in generating steam, I discovered that the temperature of steam was by no means the true measure of its

* See Mech. Mag. vol. xvi. p. 246.

power, although reposing on water, and that steam may be changed instantaneously from low to high steam of the strength of gunpowder, without any addition of heat. It is well known that in proportion to the *density* of steam, so is its power; and it was believed, that as steam increased in temperature, it would also increase in density, if in contact with water. This belief was the source of an important error.

In pursuing my experiments, though explosions frequently took place, they gave me the opportunity of witnessing some facts, never before developed to my knowledge. The first hint which I received was from the melting of the packing (which was of lead,) of the throttle valve. It appeared, by the indicator, that the temperature of the steam at the moment did not exceed four hundred degrees; but the lead which does not fuse under six hundred and fifty degrees, ran from the throttle valve like water, and permitted the steam to escape. The late Dr. Wollaston, who witnessed this new fact, was exceedingly struck with it. He accounted for it by supposing that the throttling of the steam occasioned sufficient friction to increase its temperature, so as to melt the leaden packing. As this was a plausible theory, I gave into it. But shortly after that experiment, I discovered that the steam pipe, leading from the generator to the steam engine, had ignited its non-conducting covering, which was of hempen cord, (to do which required at least eight hundred degrees of heat,) and I then became satisfied that friction was not the cause of the accumulation of heat, since during the last occurrence the steam was not throttled; and then I began to suspect that the steam, although in contact with water, had got *supercharged* with heat. I immediately instituted the following experiments:—

A generator was partially filled with water, and heated to about five hundred degrees, and was consequently exerting a force of about fifty atmospheres, or seven hundred and fifty pounds to the square inch; but the pressure valve being loaded to about sixty atmospheres, or nine hundred pounds to the square inch, it prevented the water from expanding into steam. The receiver, which was destitute both of water and of steam, was heated to about twelve hundred degrees. A small quantity of water was injected into the generator by the forcing pump, which forced out from under the pressure valve into the receiver a corresponding quantity of heated water, and this instantly flashed into steam, which, from its having ignited the hemp cord that covered the steam pipe ten feet from the generator, must have been of at least eight hundred degrees, which would be equal to about eighty atmospheres, or twelve hundred pounds to the inch; but from want of water to give it its necessary density, the indicator showed a pressure of only five atmospheres, or seventy-five pounds per inch. Whether the pressure of the steam which was rushing through the steam pipe was five or one hundred, or more atmospheres, the steam pipe kept up at the high temperature before mentioned, which I attribute to the steam being supercharged with caloric.

The pump was now made to inject a much larger quantity of heated water, and the indicator showed a pressure of from fifty to eighty

atmospheres. It soon expanded, (the throttle valve being partly opened,) to the former pressure of about five atmospheres. The water was then injected again and again, and the indicator was observed to oscillate at each stroke of the pump, from five to between forty and one hundred atmospheres, according to the quantity of water injected; clearly showing, that whenever the quantity of water was reduced, there was a great redundancy of heat, with little elastic force, and that the elastic force was suddenly increased by the mere addition of water. It soon occurred to me, that to this might be traced the true cause of the tremendous explosions that suddenly take place *in low as well as high pressure* boilers.

There are many instances where, immediately before one of these terrific explosions had taken place, the engine laboured, showing evidently a decrease of power in the engine. To illustrate this theory of sudden explosions, let us suppose the feed pipe or pump to be choked; in this case, the upper surface of the water would soon sink below some part of the boiler, which ought to be constantly covered by it, thus causing them to become heated to a much higher temperature than the water. The steam now being in contact with the heated metal, readily takes up the heat and becomes supercharged with it. Practical engineers have frequently witnessed the destruction of the packing of pistons by their becoming charred, although the steam issuing from the steam chamber was, in its lowest strata, in contact with the water, the temperature of which did not exceed two hundred and thirty degrees.

It was very evident that this steam was supercharged with heat, and was much above the temperature of the water upon which it was reposing, and in a suitable state to produce explosion, had the water been allowed to rise into and give the steam sufficient density, by any sudden *reduction of pressure* on the water in the lower part of the boiler, by drawing off part of the steam faster than it was generated.

Since caloric will not descend in water, it cannot be taken up by water placed below it. The steam thus supercharged, will heat the upper surface of the boiler in some cases quite red hot, and will ignite coals, or any other combustible matter, which may be in contact with it. This fact I can illustrate by numerous instances on record.

If the water, which is kept below the supercharged steam by the pressure of it, could by any circumstance, be made to take up the excess of caloric in the steam, as well as that from the upper part of the boiler, when heated above the temperature of the water in the boiler, whether the boiler be what is termed a high pressure or a low pressure boiler, the steam therein will instantly become highly elastic, and an explosion cannot be prevented *by any safety valve* hitherto used.

It was stated in evidence, at the coroner's inquest, taken in the Humber, in the case of an explosion on board of the Graham steamboat, that just before the explosion took place, twenty pounds weight was taken off the safety valve. Now, if the steam in that boiler had been properly generated, the relief given to the safety valve could

not have produced explosion; but if the water had got low in the boiler, (as was probably the case,) and the steam supercharged with heat, the most ready way to produce explosion was to open the safety valve, thereby allowing the water in the lower part of the boiler to rise suddenly and give density to the steam above it.

Several instances have occurred when there has been sufficient warning, by the rushing of the steam from a rent or fracture, for the bystanders to escape from injury before the explosion took place.

There has been at least one case, where the boiler was raised from its bed into the air by the force of the steam issuing from the rent, (upon the principle of the rocket,) before the water had sufficiently expanded, (by the removal of the steam caused by the rent or fracture,) to take up the heat of the boiler and supercharged steam, when an explosion took place after the boiler had been raised many feet in the atmosphere, and separated with a very great report, one part rising still higher, while the other dashed with great force on the ground.

The full persuasion of my mind is, that such explosions are remedial, by discoveries, which, for the moment, I cannot publicly mention, but which have been confidentially disclosed to an honourable member of this committee.

It is, I believe, a fact, that more persons have been killed by *low* than by *high* pressure boilers in this country, and such has decidedly been the case in America. High-pressure boilers have been substituted in Flintshire within the last twelve months, for those of low pressure, after a destructive explosion of the latter, by which sixteen lives were lost.

JACOB PERKINS.

Harpur Street, September 27, 1831. [*Mech. Mag.*

English Steam Boats.

THE subjoined article we copy from the Albany Daily Advertiser; we have been induced to transfer it to our pages from a conviction of the general correctness and value of the views which it presents. The writer, whoever he may be, is well acquainted with the subject upon which he speaks, and until the reformations suggested by him at the close of the article, or others of a similar character, are adopted, all our schemes for preventing explosions will prove abortive. Such, at all events, is the confirmed judgment of the

EDITOR.

The increasing competition on our rivers by the proprietors of steam boats, not only as regards the beauty of their construction and the excellence of their accommodations, but their number and speed, is leading the American public to give the subject of steam their thoughtful consideration. This feeling of interest has been much increased by occasional losses of property, by reason of explosions and defective machinery. It is a singular coincidence, that while

our own government was endeavouring to elicit from our men of science, the causes of these accidents, and their proper remedy, that of England was led to make an examination into the causes of the casualties upon the Thames, resulting from the speed of the steam boats on that river, and occurring to the craft which came in contact with them. An investigation took place before a select committee of the house of commons, in September last, and the information elicited is so interesting, that we have taken some pains to present to our readers the most striking features of the examination.

It appears very evident that the English steam boats, even those of the best class, do not move with an average velocity of more than nine miles an hour. That their length is rather under than over one hundred and fifty feet, and their capacity much more frequently between eighty and one hundred and fifty tons than beyond it—their draught of water six feet and upwards.

Until lately their bows were blunt—now they are universally built sharp. Many of their old boats have been lengthened. They carry masts, and their chimnies are sometimes used as such. They consider a vessel not safe after five or six years wear, though some of extraordinary strength are reported to have lasted twelve years. A survey every three years or oftener, is thought necessary. The principal ship builders recommend making the hull nearly solid all the way up, with internal fastenings, trussings and diagonal bracings, the object of which, as avowed by Sir Robert Seppings, was to give "uniform strength from stem to stern." In this opinion the principal ship builders concurred.

As an evidence of the strength of their vessels, the instance of the Ramona was adduced, the Emulous, and Confiance. The former, of three hundred and eighty-five tons, and two engines of fifty horse power, went ashore in a storm at Bologne without injury, at a time when other vessels were sunk. The Emulous went out safely to India, and is now employed in towing vessels on the Ganges, while the Confiance, a government packet, has been out at sea in all weathers, and according to the report of her commander, he has never been obliged to lay to with her. Among other things, he stated that he towed a French corvette in a gale with five hundred troops on board, at the rate of six miles per hour, for five hundred miles distance! It appears that there are forty-two steam boats belonging to the Thames in active service, and eleven that sail out of London to foreign ports. Two passengers per ton, of registered burthen, are considered a fair allowance, although four are oftener carried.

The machinery of these vessels is altogether on the low pressure principle. There is only one high pressure boat known, and that belongs to a French company and plies to Dover.

Generally they have two engines in their boats, not fastened to the timbers at the bottom of the vessels, but usually at the sides. The boilers now getting into fashion are the cylindrical, though the greater part are like those used in our own boats. The average pressure is four pounds per square inch; if it exceeds that much, it is thought

very dangerous. Explosions from the boilers are hardly known in England. Their engineers prefer a short to a long stroke of the piston, and small water wheels. They can throw their wheels out of gear at any time, and prefer that method of working their engines when lying to or preparing to start. The Canadian boats are almost all so constructed. A pressure of fifteen pounds is thought to be high pressure. The engines are stopped and started as ours are. The throttle valve appears to be the great dependence of the engineer, and very elaborate experiments were made in a government steamer, to ascertain the relation between the aperture of the valve, and the rates of going in consequence. A boat on the Tay is managed by an index on deck, a small revolving lever, which points to "stop her," "go ahead," "back her," and which any common seaman who can read may manage. Captain Hall says that he was six hours in a boat of this character, manœuvring her in every possible way, during which this hand gear must have been used fifty or sixty times, and yet the engineer never touched the engine. There is an account of this apparatus and a drawing accompanying it, in the Edinburgh Philosophical Transactions.

The English boilers are manufactured chiefly of iron, and are considered to be good for three years only. In the best boats, new ones are always substituted after this period, or the most thorough repairs made to the old at the shops of the maker. They are always placed below deck. In stopping an engine some English engineers think it highly important to regulate the injection cocks as well as the throttle valves; they reckon also, every ton of engine as equal to the power of one horse.

In many steam vessels in the united kingdom, the engine is worked on the deck as in our own.

The general management of the boats is by the captain, mate, steward, pilot, engineer, (first and second,) and a crew of from eight to twenty-five in number, proportioned to the size of the vessel. These vessels are steered by a tiller. Captain Hall has for a long time attempted to introduce the American mode of steering by a wheel. One naval officer who was examined on this point, said it would not do. Another said it would be an excellent improvement: and a pilot swore that steering was principally directed by motions made by hand. At night, however, the lookout gives his warning voice to the pilot. On the St. Lawrence, the noise occasioned by this practice will be readily recollected by American travellers.

The pilot also directs the engineer by his voice, and not by means of a bell, as in our boats.

The boats usually carry a light at the mast head and on each paddle box; and not at the bow, as with us. Captain Hall mentioned the greater brilliancy of American steam boats at night, in consequence of the furnaces being on deck, and the blaze and sparks made by the pine wood which is used for fuel.

A great variety of paddles have been tried in England; among them are the feathered, still in use, Skene's revolving paddle, out of use, and Morgan's, which is in use with some of the government

packets. The latter made a difference of almost one-third in favour of the Confiance's speed, lessened the tremor of the boat, and works proportionably faster in a heavy head sea than a calm. The engineer of this vessel describes the bucket as entering the water at an angle of 57¼°, and leaving it at 52½°, while the old worked at an angle of 25°. There is said to be no backwater of consequence, and she has towed a boat close to the water wheel without danger.

The London boats are unpopular among the wherrymen, frequently running over and destroying them. This practice appeared to grow out of the carelessness of the wherrymen, and the narrowness of the channel.

The accommodations of these boats are not to be compared to ours.

Upon a review of the subject, we are led to the irresistible conclusion that the English steam boats are not as substantial, nor as fast, nor as comfortable as ours; but they are far safer. On the Hudson river our boats are on the low pressure *plan*, but they carry from sixteen to twenty-five inches of steam, and this is nothing more nor less than high steam. The shape of our boilers is not calculated to resist such a pressure, and some tremendous accident will sooner or later occur to spread ruin and death among the crowds who venture themselves within their reach.

It certainly is possible, now that large boats are becoming so popular, to work steam at a low pressure, and to the greatest advantage; or if high steam must be used, let the cylindrical boilers come again into use.

The competition will inevitably lead to fatal consequences if public opinion does not rectify the errors of our steam navigation.

¶ *On Madder.*

(Ger. *Färberothe*; Du. *Mee;* Fr. *Alizari, Garance*; It. *Robbia;* Sp. *Granza, Rubia;* Rus. *Mariona, Krap;* Hind. *Munjith.*)

Madder is the roots of a plant, (*Rubia tinctorium,*) of which there are several varieties. They are long and slender, varying from the thickness of a goose-quill to that of the little finger. They are semi-transparent, of a reddish colour, have a strong smell, and a smooth bark. Madder is very extensively used in dying red; and though the colour which it imparts be less bright and beautiful than that of cochineal, it has the advantage of being cheaper and more durable. It is a native of the south of Europe, Asia Minor, and India; but has been long since introduced into and successfully cultivated in Holland, Alsace, Provence, &c. Its cultivation has been attempted in England, but without any beneficial result. Our supplies of madder were, for a lengthened period, almost entirely derived from Holland, (Zealand;) but large quantities are now imported from France and Turkey.

Dutch or Zealand madder is never exported except in a prepared or manufactured state. It is divided by commercial men into four qualities, distinguished by the terms *mull, gamene, ombro* and *crops.* The roots being dried in stoves, the first species, or mull, consists of a powder formed by pounding the very small roots, and the husk

or bark of the larger ones. It is comparatively low priced, and is employed for dying cheap dark colours. A second pounding separates about a third part of the larger roots; and this, being sifted and packed separately, is sold here under the name of gamene, or gemeens. The third and last pounding comprehends the interior, pure, and bright part of the roots, and is sold in Holland under the name of *kor kraps*, but is here simply denominated crops. Sometimes, however, after the mull has been separated, the entire residue is ground, sifted, and packed together under the name of *onberoofde*, or ombro. It consists of about one-third of gamene, and two-thirds of crop. Prepared madder should be kept dry. It attracts the moisture of the atmosphere, and is injured by it.

The Smyrna or Levant madder, (*Rubia peregrina*,) the alizari or lizary of the modern Greeks, is cultivated in Bœotia, along the border of lake Copais, and in the plain of Thebes. It also grows in large quantities at Kurdar near Smyrna, and in Cyprus. The madder of Provence has been raised from seeds carried from the latter in 1761. Turkey madder affords, when properly prepared, a brighter colour than that of Zealand. It is, however, imported in its natural state, or as roots: the natives, by whom it is chiefly produced, not having industry or skill sufficient to prepare it like the Zealanders, by pounding and separating the skins and inferior roots; so that the finer colouring matter of the larger roots being degraded by the presence of that derived from the former, a peculiar process is required to evolve that beautiful Turkey red which is so highly and deservedly esteemed.—(*Thomson's Chemistry; Bancroft on Colours*, vol. ii. pp. 221—278: see also *Beckmann, Hist. of Invent.* vol. iii. art. *Madder.*)

In France, madder is prepared nearly in the same manner as in Zealand. The following instructive details as to its cultivation, price, &c. in Provence, were obligingly furnished to us by an English gentleman intimately acquainted with such subjects, who visited Avignon in the autumn of 1829.

"This town, (Avignon,) is the centre of the madder country, the cultivation of which was introduced here about the middle of the eighteenth century, and, with the exception of Alsace, is still confined, (in France,) to this department, (Vaucluse.) The soil appears to be better adapted for its cultivation here than any where else, and it has long been the source of great wealth to the cultivators. Of late years, however, the prices have fluctuated so much, that many proprietors have abandoned, or only occasionally cultivated this root, so that the crop, which was formerly estimated to average 500,000 quintals, is now supposed not to exceed from 300,000 to 400,000.

"The root is called *alizari*, and the powder, (made from it,) *garance*. The plant is raised from seed, and requires three years to come to maturity. It is, however, often pulled in eighteen months without injury to the quality, the quantity only is smaller. A rich soil is necessary for its successful cultivation; and when the soil is impregnated with alkaline matter, the root acquires a red colour—

in other cases it is yellow. The latter is preferred in England from the long habit of using Dutch madder, which is of this colour; but in France the red sells at two francs per quintal higher, being used for the Turkey red dye.

"It is calculated that when wheat sells at 20 fr. per hectolitre, *alizari* should bring 35 fr. per quintal, (poids de table,) to give the same remuneration to the cultivator. That is, wheat 63*s*. per Eng. quarter, and *alizari* 34*s*. per Eng. cwt. The price has, however, been frequently as low as 22 fr. per quintal.

"Prices undergo a revolution every seven or eight years, touching the minimum of 22, and rising as high as 100 fr. As in every similar case, the high price induces extensive cultivation, and this generally produces its full effect four or five years after. The produce of Alsace, which is inferior both in quantity and quality to that of Vaucluse, is generally sold in the Strasburg market.

"England employs both the root and the powder, according to the purpose for which they are intended. The Dutch madder is more employed by the woollen dyers, and the French by the cotton dyers and printers.

"In making purchases of *garance* it is essential to employ a house of confidence, because the quality depends entirely upon the care and honesty of the agent. The *finest* is produced from the roots after being cleaned and stripped of their bark. The *second* by grinding the roots without cleaning. A *third* by mixing the bark of the *first* while grinding; and so on to any degree of adulteration.

"The price of *alizari* in the country, which was only 25 fr. in July, is now, (November,) 1829, at 36 fr. and is expected to be 40 fr. very shortly. The crop being deficient both here and in Holland, and the certainty of its being also deficient next year, added to the small quantity existing in England, give reason to believe that the price will reach 60 fr. before many months, and will continue to advance for a year or two more.

"The *quintals* above mentioned are of 100 lbs. *poids de table*—the weight in general use over the south of France, and even at *Marseilles*. This weight is different in the different provinces, varying from 22 to 25 per cent. lighter than the *poids métrique*. At Avignon 124 lbs. p. de table = 50 kilog., consequently 126 lbs. are equal to 1 cwt. Eng. At the exchange of 25.50, the cwt. costs, (including 11*s*. for freight, duty, and all charges till delivered in London or Liverpool,) 61*s*. or 60*s*. The selling price is quoted in England at 62*s*. only.

It is considered that only one-sixth or one-seventh of the present crop remains for sale.

Madder does not deteriorate by keeping, provided it be kept dry.

Compte simulé.—

	Fr.
Cost of one quintal of roots in the country - -	35
Expenses in do. - - - - -	2
	37

The root gives 85 per cent. powder, consequently 1 quintal powder	=	43.50
Grinding	"	2
Cask	"	1
Transport	"	2.50
	F.	46.75
		Fr.
The English cwt. costs, therefore,		58.85
All expenses till on board at Marseilles		3
	F.	61.85

Besides commission.

For an account of East India madder, or munjeet, see munjeet.

The imports of madder have not materially varied for a considerable period. Of 70,017 cwt. of prepared madder imported in 1829, 38,579 were brought from Holland, and 31,352 from France. During the same year the imports of madder root amounted to 33,541 cwt. of which 14,592 were brought from France, 14,007 from Turkey and Greece, 2,376 from Holland, and 2,135, (munjeet,) from India. The exports of Madder from Great Britain are trifling.

The duty on madder is 6*s.* per cwt. on prepared, and 1*s.* 6*d.* per do. on roots; and its price, duty paid, in the London market, October 1831, was as under:—

	£	*s.*	*d.*		£	*s.*	*d.*	
Madder, Duch Crops -	4	0	0	to	4	10	0	per cwt.
Ombro -	3	5	0	—	3	15	0	—
Gamene -	2	3	0	—	3	12	0	—
Mull -	1	0	0	—	2	2	0	—
French - -	0	0	0	—	4	5	0	—
Spanish - -	2	16	0	—	3	9	0	—
Madder Roots, Turkey -	2	10	0	—	2	12	0	—
French -	2	8	0	—	2	9	0	—

Madder is not to be imported for home consumption except in British ships, or in ships of the country of which it is the produce, or from which it is imported, under forfeiture of the same, and 100*l.* by the master of the vessel.—(6 *Geo.* 4 c. 109; 7 & 8 *Geo.* 4. c. 56.)

[*Com. Dict.*

Extinction of Fires in Factories.

Sir,—May I desire of you to insert in your valuable periodical two letters which I published in two provincial papers, respecting the extinction of fires in factories, and to which I see you have alluded in one of your late numbers, (page 240, vol. xvi.) I am induced to make this request, with a design of making them more extensively known than they possibly could be through the medium of their original publication, and with the hope that they may lead to some im-

portant results. I desire also to correct some errors contained in your brief notice of them in the number to which I have alluded.

Yours, &c.

Jan. 1, 1832. T. WATERHOUSE.

I. Letter from Mr. Waterhouse to the editor of the Preston Chronicle.

SIR,—Having observed in your Chronicle of last week, an account of the destruction of Messrs. Eccles's factory by fire, I beg permission, through the same medium, to suggest a plan by which similar conflagrations might be in a great measure prevented.

It is well known that steam possesses the power of speedily extinguishing combustion, that it can be generated in factories even during the night in ten minutes or a quarter of an hour, and that it can be diffused through almost any space in a few minutes. Upon these facts my plan is based—it is the following:—Let there be a pipe connected with the steam boiler, larger or smaller, according to the extent of the building. Let this pipe pass up the staircase, and from it, one or two smaller pipes branch off into each room. These branches should extend from one end of the room to the other, and a number of apertures should be drilled into them at certain distances, say two feet asunder. To the branch, or branches, before they enter the room, let a stop cock be fixed, and let the main pipe, as it issues from the boiler, be supplied with another stop cock. When a fire is discovered in an apartment, if in the night time, the person who makes the discovery, instead of wasting a considerable length of time in alarming the neighbourhood, will merely have to go and turn the cock that is affixed to the branch, and the one belonging to the main pipe, and then add a quantity of fuel to the fire to generate the steam. By these means the room may be filled with steam, and the conflagration consequently extinguished in at least twenty minutes. If in the day time, by simply turning the cocks the fire might be subdued in five minutes. This is the whole of the plan, and of its success I have no doubt, unless its simplicity prevent its adoption.

The advantages of this method of extinguishing conflagrations over those which are at present employed, are many and important. When fire engines are employed under the most favourable circumstances, as when they are kept upon the premises, and men at hand to work them, it is often found to be difficult to subdue a considerable conflagration. The stream of water can only be propelled upon a very limited portion of the building at once, and that not always the part where the fire is most active. And should their employment be crowned with success, the buildings must be almost deluged with water. If engines are not on the premises, a very great loss of time may be sustained before they can be procured, as was the case when Messrs. Eccles' factory was consumed, where the engines did not arrive till two hours after the fire was discovered. Engines are often out of repair, and much time is frequently lost in procuring a sufficient number of men to work them. I am aware that in some factories water can be forced through the buildings by the engine in pipes arranged for the purpose. Even according to this plan, the engine

must be put in action before the water can be propelled; a large quantity of water must still be ejected to quench the flame; the presence of a person to direct the current of the water is required, and the cold water will condense the heated air in the room, and cause a great influx of air from without, a circumstance which will materially contribute towards maintaining the combustion. By the plan which I have suggested, a boy might extinguish almost any conflagration. The time occupied in putting it in force, would only be ten or fifteen minutes at night, and not more than five minutes in the day time. The presence of no one to direct its operations would be necessary, and it might be made to act on every part of the building at once; the quantity of water expended would not, at the most, exceed a few gallons; and instead of promoting an influx of air into the room, the steam would displace that which was in the apartment previous to its admission; besides, the injury that the machinery would sustain, would be considerably less than is occasioned by the mode at present adopted.

These are advantages such as I trust will induce some of the proprietors of mills to give the scheme their deliberate consideration. I am sanguine enough to believe, that if it were employed, almost a perfect immunity from fire would be possessed, and insurance might be wholly dispensed with. I must apologise for the length of this letter, but I trust you will not deem me presumptuous, when you consider that my object is to point out a method of protecting property, and to prevent the distress incident to the work people from its destruction. These considerations, I hope, will induce you to give these remarks publicity, and prevent you from excluding my communication because of its extension.

I am, sir, your humble servant,

Preston, Sept. 27, 1831. T. Waterhouse.

II. Letter from Mr. Waterhouse to the editor of the Lancaster Herald.

Sir,—Having observed in your Herald of last week, a paragraph relative to the extinction of fires in sugar houses, &c., by means of steam, may I be permitted to make known to the readers of your excellent paper the following experiments, which, by the extreme politeness of Mr. William Taylor, of Preston, and with the assistance of some friends, I have been able to make on this interesting and important subject, on a large scale.

"The drying house connected with the moss factory was the place selected for the purpose. It is twenty-six feet long, fifteen wide, and about twelve feet high. In the centre of this room was placed a large iron platform, erected on bricks, to prevent the floor from sustaining any injury from the fire; and a quantity of sheet iron was suspended above, to protect the roof. To a large pipe beneath the floor, a branch, about two yards long, and two inches in diameter, was affixed, furnished with a tap. The main pipe communicated with another issuing from the boiler, which was at a considerable distance. Having closed every aperture through which atmospheric air might have gained ingress, and allowed the steam to flow into the pipes

until they were sufficiently warmed, we piled a quantity of shavings and oily cotton waste on the centre of the iron platform, out of the current of the steam—ignited them, turned the tap, and closed the door. The steam being subjected to a pressure of about four pounds on the square inch, rushed into the apartment with considerable velocity, and soon filled it with a dense vapour. We watched the effect produced through a window, and in five minutes we observed the flame to flicker and expire, when the room was in total darkness, it being night. On opening the door, nothing could be perceived, but in a few minutes the smoke and steam subsided, and then a few red embers were discernible. In a few minutes more, the atmosphere in the room became clear, and the embers partially kindled up again. This experiment was repeated two or three times with a similar result, although in one of them pieces of wood were used instead of shavings and cotton waste. In the experiment with the fire of wood, after we had ascertained that the flame was extinguished, we re-closed the door, and allowed it to remain so for fifteen minutes longer. On again opening it, after the expiration of that time, we found that the embers were still burning, but dimly; and on admitting a free access of atmospheric air, were again inflamed. These experiments were tried on the 12th of this month, in the presence of Mr. William Taylor, Mr. Adcock, lecturer on mechanical philosophy, Mr. Elsworth, civil engineer, Mr. Harrison, surgeon, and several practical engineers and spinners. On Thursday the 17th, assisted by Mr. Harrison, I repeated the experiment with a little variation in the same room. We procured a stove grate from Mr. Taylor, kindled a quantity of coke in it, placed it on the platform, out of the direction of the mouth of the branch pipe, and allowed the steam to rush into the room, with a pressure of three and a half pounds to the square inch. We observed that the fire lost much of its intensity, but could not be extinguished. The grate was then removed into the current of the steam, distant from the mouth of the pipe about six feet, when we observed that the coke burnt with great brightness, and a lambent flame issued from the top of the grate. It was obvious that the steam in this experiment was decomposed when it came in contact with the fire, the oxygen meeting with carbonaceous base, and the hydrogen burning on the surface, and uniting with the oxygen of the atmosphere to form water. The coke was then removed from the grate, and its place supplied with shavings and cotton waste. The grate was then placed out of the direction of the steam, the combustibles ignited, the steam allowed to rush into the room, and the door closed. The flame was extinguished in five minutes, as before; but the embers were still smothering, though not sufficient fire remained to rekindle the combustible matter until the grate was brought out of the room into the cold atmosphere. This experiment was several times repeated with the same result. A lantern was then procured and suspended from the ceiling, about two and a half yards above the steam pipe, lighted, and the steam allowed to issue from the pipe while the door was kept open. In a quarter of a minute the light was put out. The back of the lantern was then turned towards the opposite wall,

against which the steam was driven, and the recurrent steam was prevented from coming directly against the light by the door of the lantern, so that it could not act upon it till it was generally diffused. In this experiment, the light was extinguished in thirty-five seconds. We had now indubitably proved that flame could be put out by steam in a close apartment in a few minutes, when the conflagration was considerable; and in a few seconds in an open room, when small. And it now remained to ascertain if steam would exert any influence over flame, when a free access of atmospheric air was permitted. This we tried by kindling a fire in the grate of shavings and cotton waste, and placing it out of the current of the steam, while the door was kept wide open. In this experiment the flame expired in four and a half minutes.

Observations.

By these experiments it is proved—

1st. That steam will extinguish a large conflagration in a close apartment in five minutes, when it is driven into the room in considerable quantity.

2nd. That it does not possess the power of preventing a low or charring combustion.

3d. That when a current of steam is impelled against a large fire, it increases the combustion in a remarkable degree.

4th. That a small flame is almost immediately extinguished when suspended in an open apartment into which a considerable volume of steam is rushing.

5th. That steam will subdue flame in an open room as rapidly as in a close one.

From these facts I am disposed to infer, that steam would be of great use in restraining conflagrations in factories or other places where it could be rapidly generated in large volumes; and that it would be of great service, especially in such buildings as are at a considerable distance from engines, or where some length of time must elapse before assistance can be procured, as the watchman could, in fifteen or twenty minutes, diffuse a sufficient quantity to arrest the flame, if pipes were properly arranged for that purpose, according to a plan I laid before the public a few weeks ago in the Preston Chronicle. In all factories in which the conflagrations are very rapid, from the combustibility of the materials they contain, it would be of great use, from the same cause (its easy application,) and would considerably lessen the quantity of water that would afterwards be required to totally quench the burning embers. I fear, sir, that I have already encroached too much upon your columns, but I trust the importance of the subject will be admitted as an apology.

I am, sir, yours respectfully,

T. Waterhouse.

Preston, Nov. 19, 1832.

Defence against Flies used by the Butchers of Geneva.

It is said that the butchers of Geneva have for a long time used the oil of laurel as a substance which prevents the flies from approaching their meat. The odour of this oil, though strong, is not very disagreeable, and the flies will not approach the walls or parts which have been rubbed with it. The person who describes these effects says, that he has, in this way, guarded the gilt frames of mirrors and pictures more perfectly from flies. [*Recueil Industriel.*

Meteorological Observations for May, 1832.

Moon.	Days.	Therm. Sun rise.	Therm. 2 P.M.	Barometer. Sun rise.	Barometer. 2 P.M.	Dew point	Wind. Direction.	Wind. Force.	Water fallen in rain.	State of the weather, and Remarks.
				Inches.	Inches.				Inches.	
⊗	1	44°	61°	29.65	29.62	29	W.	Blustering.		Clear—flying clouds.
	2	36	51	.84	.84	25	W.	Moderate.		Cloudy—clear.
	3	43	56	.53	.40	47	SE. W.	Blustering.	.21	Rain—flying clouds.
	4	33	52	.84	.80	20	W.	do.		Clear day.
	5	35	44	.90	30.00	12	N. NW.	do.		Clear day.
☽	6	42	50	30.20	.20	11	N. NE.	Moderate.		White frost—hazy.
	7	28	50	.10	.00	36	E.	do.		Clear day.
	8	36	49	29.90	29.90	19	N. NW.	do.		Clear day.
	9	36	44	30.15	30.20	10	N. E.	do.		Cloudy—clear.
	10	32	52	.20	.10	25	SW.	do.		Cloudy—hazy.
	11	38	68	29.90	29.80	40	SW. S.	Breeze.		Hazy day.
	12	46	72	.80	.80	44	W. S.	Calm.		Clear—hazy.
	13	46	76	.73	.70	47	W. S.	do.		Hazy day.
	14	50	79	.60	.69	38	SW. W.	Blustering.		Hazy day—very dry.
⊗	15	45	46	.70	.74	34	SE.	do.		Cloudy day.
	16	36	44	.70	.57	40	E.	do.		Drizzle—drizzle.
	17	44	48	.50	.50	44	NE.	do.		Drizzle—drizzle.
	18	44	47	.00	.70	41	NE.	Moderate.	1.30	Drizzle—cloudy.
	19	42	48	.00	.60	43	N. NE.	do.		Drizzle—cloudy.
	20	42	48	.00	.60	37	N. W.	do.	.03	Drizzle—cloudy.
	21	43	50	.74	.83	33	NW. W.	do.		Clear day.
	22	49	60	.83	.83	28	NW.	do.		Clear day.
☾	23	41	58	30.00	.95	26	E.	do.		Clear—cloudy.
	24	40	54	29.90	.93	37	NW.	do.		Cloudy—clear.
	25	48	69	.90	.90	54	S.	Blustering.		Cloudy day.
	26	50	70	.70	.80	56	SW.	do.		Clear—hazy.
	27	55	70	.60	.70	58	S.	Moderate.	.27	Cloudy—clear—rain.
	28	40	50	.90	.90	36	E. NE.	do.		Cloudy day—rain.
	29	42	49	30.00	30.05	36	S. E.	do.	.10	Drizzle—cloudy.
⊗	30	41	44	.00	.00	42	S. E.	do.	.54	Rain—cloudy.
	Mean	41.00	55.07	29.81	29.81	34.83			2.37	

	Thermometer.	Barometer.
Maximum height during the month,	79. on 14th.	30.20 on 6th, 9th, and 10th.
Minimum do.	26. on 6th.	29.40 on 3d.
Mean do.	48.03	29.81